SCIENTIFIC AMERICAN

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ROYAL E. HOUSE'S TELEPHONE OF 1868.

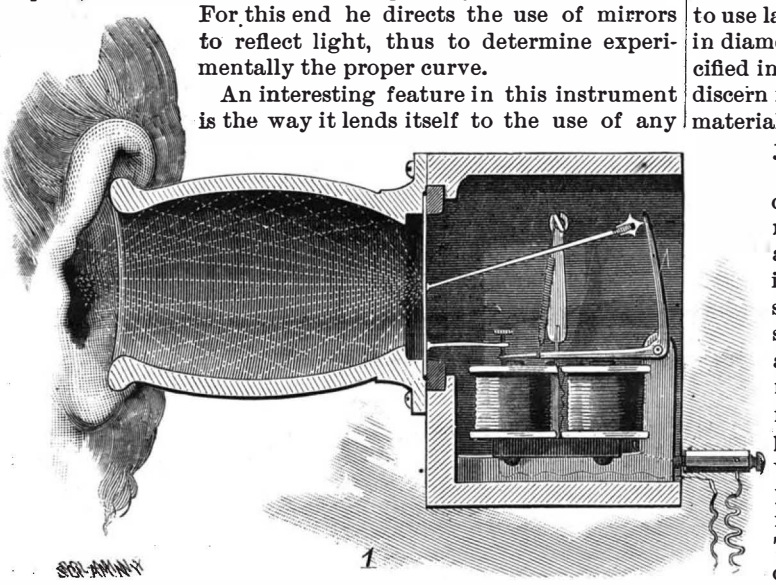
We illustrate in the cuts accompanying this article an object of much interest at the present day, when the telephone controversy has reached such proportions. It is an "electro-phonetic receiver," for use in telegraphy, invented by Royal E. House, and patented by him in letters patent No. 77,882, of 1868. This name was given it by the inventor. It is really a telephone.

A box of generally cubical form has one end closed with a diaphragm. Two slender bars of metal are attached to the diaphragm, one near the center, the other below it. These bars the inventor terms "limiters." The upper limiter limits the motion of an armature working over a magnet, so that it cannot come in contact with the poles. The other limiter prevents the armature from receding too far from the poles. The armature is pivoted at one end. Its inner and free end strikes the lower limiter; it is provided with an extension at the pivoted end that extends upward at right angles to the armature. The end of this arm bears against the upper limiter. An electro-magnet operates this armature, and is situated below it in the bottom of the box, and is connected to binding posts. A tension spring is used to adjust the pull of the pivoted armature away from the magnet.

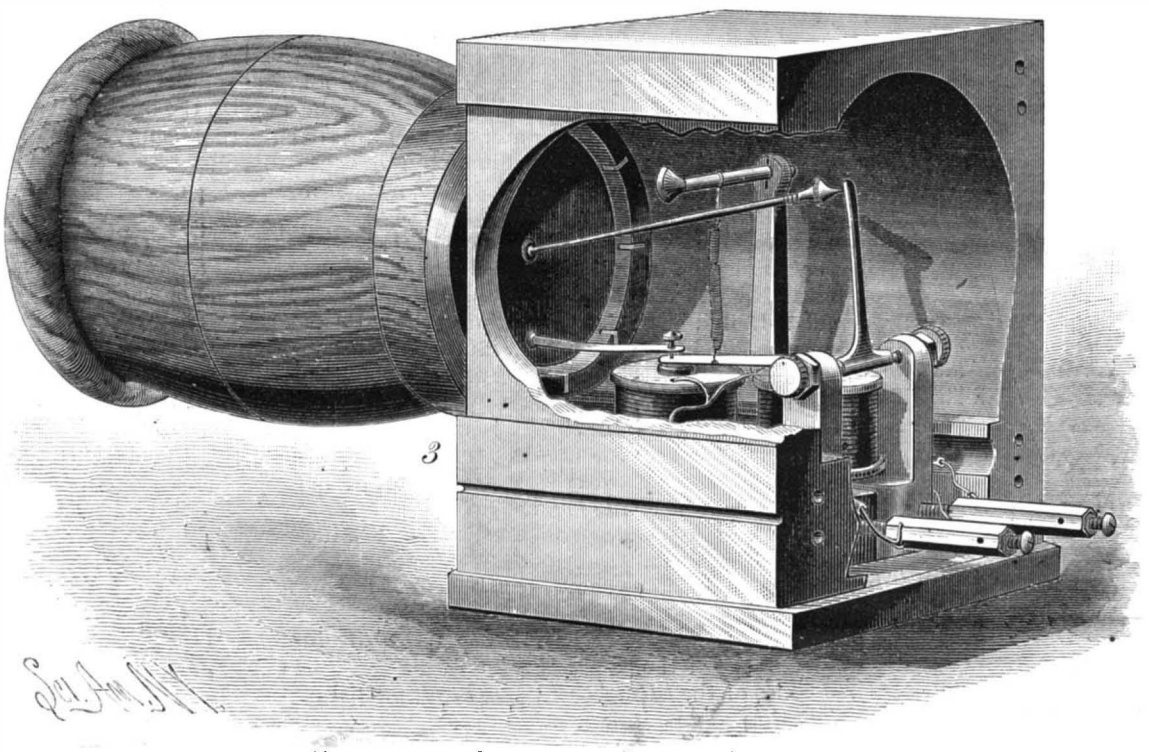
The box has attached to it an ear trumpet or reflector that surrounds and extends outward from the diaphragm. Both limiters have adjusting screws. By these their freedom of movement may be varied. They can be adjusted so that they will be in contact one at a time only with the armature and arm. In this case a make and subsequent break, or corresponding and considerable changes in intensity of current, will produce two blows, the first on the upper limiter and the second on the lower. On the other hand, by screwing out the limiter screws to a fuller extent, this oscillation will be gradually reduced until no break is possible. Then makes and breaks of the current, or variations in intensity, will no longer produce blows, but a true telephonic sound on the diaphragm. If connected in circuit with a microphone transmitter, it will talk; and if two are connected having closed or ground circuit with battery, or if steel or cast iron magnet cores are used without any battery, they will act as receivers or transmitters, and form a complete telephonic system.

The apparatus is a perfect telephone, immeasurably superior to anything shown in the Bell patents of 1876 or 1877. The subject of Figs. 1 and 3 of our drawing is a reproduction of the model accompanying the patent, which model was destroyed in the Patent Office fire. Its sides in the elevation are broken away to show the interior construction. In the section it is shown in use as a receiver. The inventor's idea of his ear trumpet was that it should operate as a reflector of sound waves. He gives directions for constructing the interior surface of such form as to reflect the sound waves to a focus to be occupied by the listener's ear. For this end he directs the use of mirrors to reflect light, thus to determine experimentally the proper curve.

An interesting feature in this instrument is the way it lends itself to the use of any material for the diaphragm. In this respect it resembles strikingly Bell's instrument of the 1876 patent. In both of the systems, the armature is distinct from the sounding part. The inventor's idea was, if desired, to use large diaphragms. Some as large as eight inches in diameter have been constructed, this size being specified in the patent, and work very well. It is easy to discern in the instrument a great flexibility as to size, material, and other modifications, its system of adjustment is so complete.



ROYAL E. HOUSE'S TELEPHONE OF 1868.



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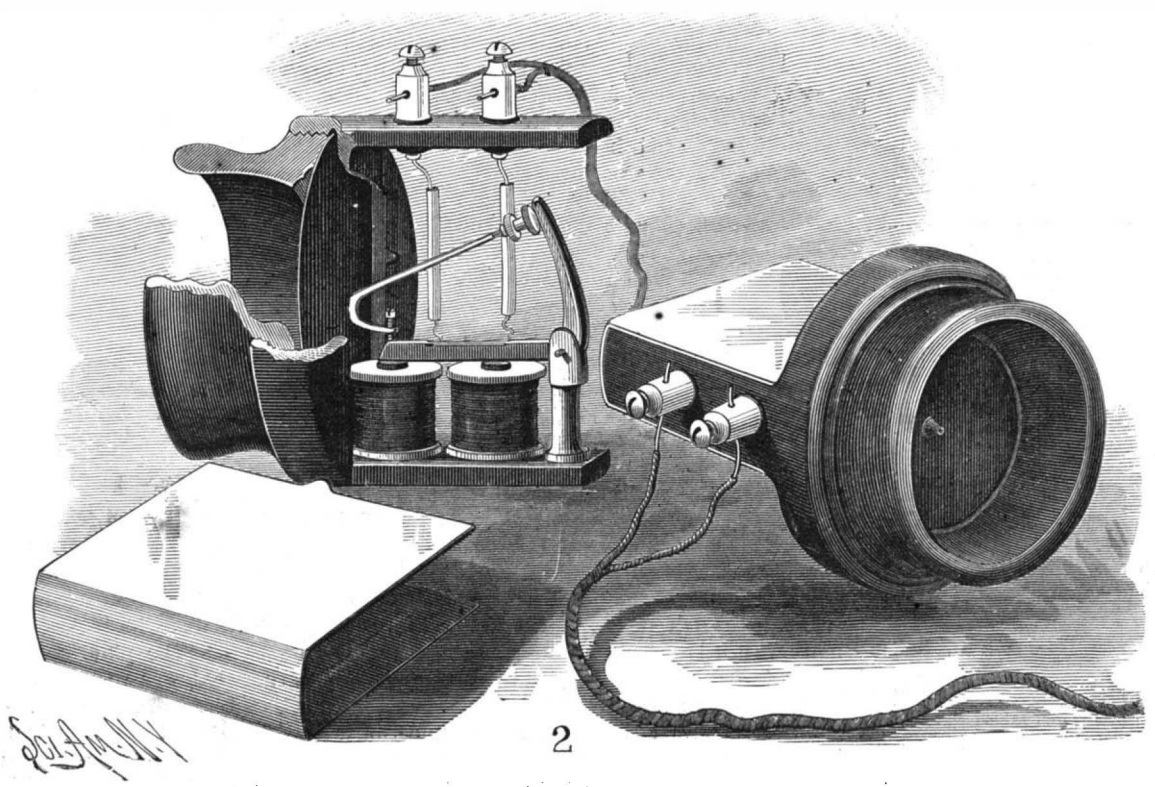

HOUSE'S MODERN PHONETIC TELEGRAPH.

The two figures described above are exact copies of the patent drawings. To adapt it to modern use some minor changes in proportions and material have been introduced, which are illustrated in Fig. 2. The frame or body is constructed of cast iron. The magnet cores are screwed into one arm of this frame, and bobbins are placed around them. An ebonite ear or mouth piece screws on the open end of the frame, and clamps the metallic diaphragm in position. This ear piece is made shorter than was the corresponding part of the model of the patent. A two branched limiter is substituted for the pair of separate limiters of the original. The result is a more compact instrument. A cover of brass or German silver incloses the principal working parts. Binding posts are attached to one of the arms of the frame opposite to the magnets. Thus the frame forms the back piece of the magnet. The double limiter is provided with adjusting screws. This instrument is a serviceable, distinct telephone. We very recently were present at a trial of its capacity over a fair length of line. Four Leclanche cells were in circuit. The same instruments were used for receivers and transmitters. The action was perfect. There was no choice of sounds. Sibilants were as clearly transmitted as any other utterances. The writer in listening to them had several standards. He had listened to one of the first of the Bell telephones in 1877 or thereabouts, at the Stevens Institute in Hoboken. The other standards were reproductions of the Reis telephones, which he had also experimented with. The House telephone was far superior to either of these. Its work was fully as good as that of the Bell telephone and Blake transmitter of to-day. The modern instruments, it will be noticed, do not differ except in constructive detail from the device of the patent. They are a true reproduction of it. It is most interesting to place the name of the inventor of the first printing telegraph by the side of Reis, Edison, Bell, and Gray, as the inventor and constructor of one of the early telephones.

The Wallace Telephone Co., of 150 Broadway, N.Y., will soon be prepared to supply these instruments.

THE Japanese Government paper mill is manufacturing pocket handkerchiefs and clothing of paper pulp containing a mixture of linen threads.

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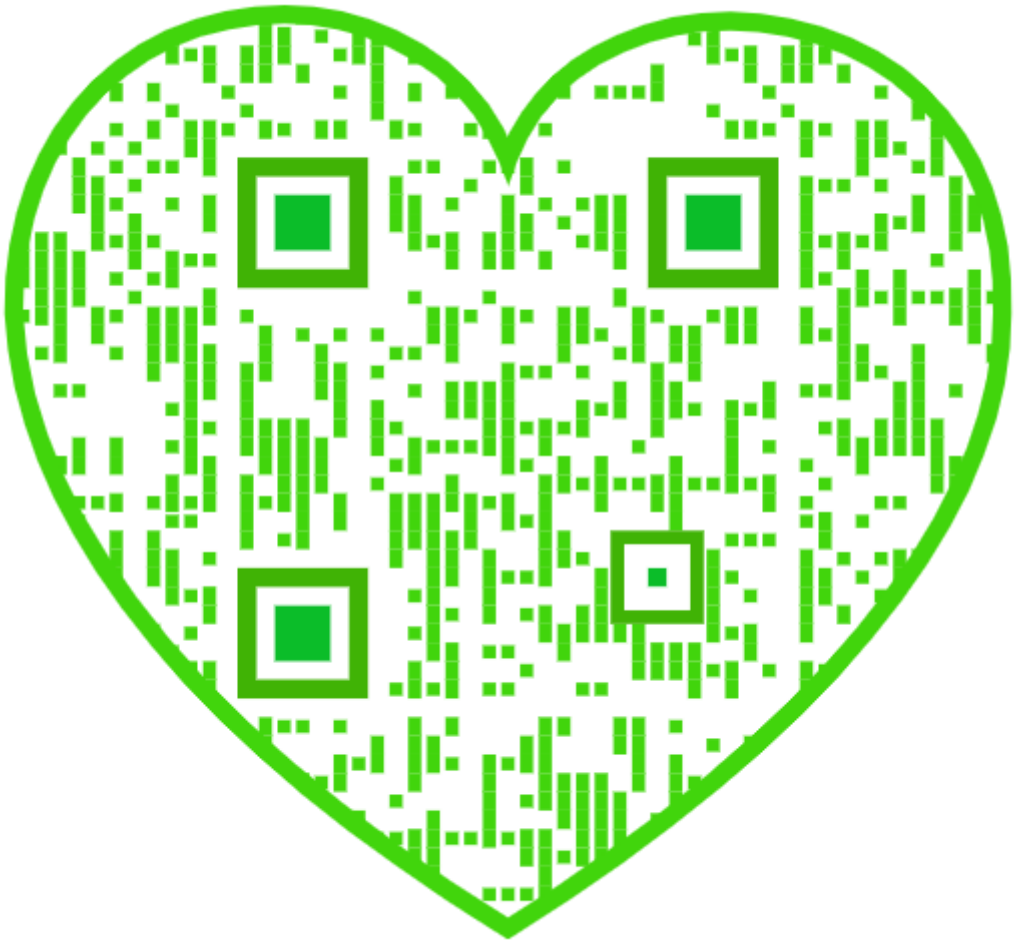

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THE BELL TELEPHONE PATENT PROBABLY BROKEN.

The claims of the Bell patent as at present construed by the courts cover the art of transmitting speech electrically. In the face of the famous Morse decision, a construction of claim fully as broad as that refused to Morse has been contended for and obtained by the Bell advocates. It is construed to cover the transmission of speech by the "undulatory current." By this current the diaphragm of a receiving instrument is assumed to be kept under permanent control of the diaphragm of a transmitter. It is all theory, but as accepted by the courts as a standard for judging of mechanical constructions, has a most important bearing on the extent of protection afforded by the Bell patents. It makes this protection absolute for all and every imaginable electric telephone.

The scope conceded to this claim is quite incompatible with the state of the art as illustrated by the Reis device alone. If any one had affirmed a few years ago that from the records of the American Patent Office a complete anticipation of this broadly interpreted patent of Bell would be exhumed, none would have credited the assertion. Yet this has now been done. A telephone far superior to Bell's crude and inoperative device of 1876, or the somewhat better one of 1877, is illustrated in our columns elsewhere. It is an exact reproduction of a device patented by the early telegraphic inventor, Royal E. House, in 1868. His name is one of the best known in connection with the early history of the art. He was the first inventor of a printing telegraph. He stands side by side with Prof. Morse and Prof. Bain in the history of electric progress. To-day, nearly eighty years old, he still lives, connecting the past with the present.

Royal House, in 1865, patented what he termed an Improvement in Electro-phonetic Telegraphs. No relay was used in this system; by increasing its sensibility, he hoped to avoid the necessity for one. In this way Morse's claims would not be infringed. Not satisfied with his progress, a second improvement under the same title was patented three years later, and the new device was a telephone.

This 1868 patent describes a perfect telephone, designed to work as a telegraph receiver. The loud and very disagreeable clicking that a telephone under certain circumstances produces is familiar to all. It works as a sort of magnifier of sound. To make the sound produced by the make and break of a weak current acting on an armature more audible, Royal House availed himself of this telephonic principle. He invented a sounder that could work with very weak currents, because it was a telephone. It possessed a diaphragm and tube adapted for listener or speaker, just as the Bell telephones in his patents of both 1876 and 1877 did. The instrument may be adjusted so that changes in current will produce blows upon the diaphragm, or by adjusting screws the production of blows may be prevented and changed into that of impulses only. When this change is made, the apparatus for production and use of the "undulatory current" appears. According to the description of the House patent, a minute change in the adjusting screws will effect this. He contemplates a motion of the armature of only one hundredth of an inch. An adjustment to this extent by screws shown in the patent drawings is therefore enough to prevent the hammering.

That this species of adjustment came within the literal scope of the patent is not only evident from the presence of the adjusting screws, but is proved by the following very remarkable clause in the specification: "I have found, by experiments, that when the force of an armature of a receiving magnet is expended on limiters, F^1, F^2, by limiting the motion of the armature a distinct, audible sound is produced, even when the electrical power is only sufficient to produce motion."

The inventor, in other words, had tried the effects of reducing the play of the armature, and there is no doubt that eight years before the invention of Bell, Royal E. House had heard the impulses of a telegraphic current audibly reproduced telephonically by the "undulatory current." The inventor, it is true, did not realize the full powers of his invention. Two of these instruments actuated by a battery or by their residual magnetism will operate as well, or better, than a pair of the modern Bell telephones. Prof. House did not specially claim or describe them as speaking instruments in his patent. Neither did Bell do so in his 1876 patent with reference to his instruments. But a device is protected by letters patent for all possible uses, and some very curious results may yet follow if suits are brought against the Bell Company under this patent.

An interesting confirmation of our views so frequently expressed as to the Bell claim is afforded by this patent. It overshadows, in importance, the Reis inventions, as it is so much their superior in efficiency. Neither is it a crude and impracticable telephone, like the earlier Bell devices. On the contrary, by legitimate inventive work, Royal E. House, the contemporary of Morse, constructed a telephone as good as the instrument in use at the present day.

One fortunate circumstance in connection with this instrument, as concerns its use in litigation, is that all the facts can be so concisely proved. The patent, in a clear drawing and description, shows what the instrument is. A simple inspection shows that it is a telephone. By connecting two of them in a circuit they will talk, thus practically showing that they are telephones. The date of the invention is far enough back to remove all danger of claims of priority of invention on Bell's part. The bearing of this invention on the extravagant claims of the telephone monopoly would seem very evident. If it can ever be brought before the courts, it will be an entirely new matter and will justify a new decision by a circuit judge. At present these judges are governed by decisions already rendered. But this new matter in the shape of a prior patent, the most convincing of all proof, must certainly force a new decision that will limit the Bell claims. An attempt is now to be made to bring it before the circuit court on a final hearing.

Interesting in the abstract as this case may be as a feature in the history of the invention of the telephone, it assumes great importance in view of the aspect that the Bell controversy has recently acquired. Charges affecting the integrity of the methods of the Patent Office have been recently made an issue in government proceedings against the Bell patents. It is alleged that the Bell patents were fraudulently granted, that Bell was given access to Gray's caveat, and that corruption marked the whole of the proceedings in the matter of his 1876 patent. So serious were these allegations that the government suit mentioned above was instituted solely on their account, and is now in progress to determine their truth or falsity. The confirmation afforded them by this discovery falls little short of absolute proof. The examiner must have known of the House patents. Their inventor's name was famous. The subjects of the Bell and House patents were similar or almost identical. The drawings resemble each other closely. Interpreted by the specification, Bell's device is anticipated by a vastly superior apparatus. It is unfortunately a matter hardly susceptible of doubt that the contents of the House patent were known to the authorities when the Bell patent was granted. For the general public this patent will seal the condemnation of the Patent Office proceedings. The matter should have a great effect on the government suit.

Meanwhile, some of the old cases are beginning to appear in the Supreme Court of the United States. On the first of the present month motion was made in that court to advance and hear together, immediately after the February recess, all the telephone suits on the docket. Twenty-five thousand printed octavo pages are in the records of these suits. The argument on the united cases is expected to occupy a week. They include the Dolbear, the Molecular, the Clay Commercial, the People's (or Drawbaugh), and the Overland suits.

Progress in these suits will be watched by all with much interest. Unfortunately, none of the cases represents the full proofs, as they are all burdened with concessions, or characterized by omissions of some parts of the facts in the case. More results may reasonably be looked for from the House telephone than from the Supreme Court.

THE RECENT BOILER EXPLOSION AT CHARLOTTE, N. C.

In our issue for October 30, we gave an account of the explosion of a boiler at the Cotton Compress Works, Charlotte, N. C., in which our correspondent stated that it was an Abendroth & Root boiler that gave way. The boilers of this firm are well known throughout the world as safety boilers, the water being contained in small, strong tubes, which alone are exposed to the fire, and are capable of enormous resistance. The principle of construction is such that only by gross mismanagement could the boiler proper be made to explode. We are therefore not surprised, on receiving additional particulars, to learn that it was not the boiler proper that caused the mischief; but it was an old, worn out steam drum that exploded, and which the cotton press people had caused to be constructed and attached to the boiler, wholly without the advice or knowledge of the boiler makers. We have seen a letter from Mr. H. W. Edwards, superintendent of the Charlotte Cotton Compress Company, who positively certifies to the above effect, and it settles the question.

We deem it only just to Abendroth & Root Mfg. Co., and to their many customers in all parts of the country who have their boilers in use, to make the above facts known.

A REMARKABLE RAILWAY ACCIDENT.

A recent accident at Perkasie, Pa., tunnel shows the importance of their ventilation. The above tunnel is about half a mile long. Repairs are being made therein. On the 3d inst. some fifty men were at work near the center of the tunnel, when a freight engine, unable to draw its train through the tunnel, became "stalled" near the place where the men were at work. Fresh coal was put in the locomotive furnace, and the fan blast set in motion. Soon the train started, when it acted as a piston in a cylinder, driving the gases from the furnace before it; and when the gases struck the men who were working in the tunnel, they nearly all

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fell as if dead. With no premonition, about forty of them became almost instantly unconscious, and fell as they stood.

One of the men, only partially affected, made his way to the tunnel entrance and gave the alarm. A gravel train, with flat cars, happened to be standing there. It was run in to the place of the accident, and the bodies of the fallen men were dragged upon the cars and taken out to the fresh air. All were supposed to be dead, but, to the surprise of the rescuers, the recently dead men soon began to show signs of life, and in a short time all were themselves again, except one poor fellow, who died, and who, in his fall, sank into a pool of water, and probably was drowned.

One of the unconscious men was found hanging on a ladder, head downward, suspended by his feet.

THE NEW NAVY.

The recent expression of opinion, by naval authorities here and abroad, as to the needs of our navy and how far the types of the new ships are likely to meet them, furnishes us with important data. By far the major part of the testimony confirms the view frequently expressed in these columns that small, fleet-footed cruisers are more to be desired than ponderous, unwieldy fighting ships, and that torpedo boats are necessary to an effective defense. While it can scarcely be said that the new ships, as far as constructed, are altogether satisfactory, eminent authorities on both sides of the water seem to be agreed that we have made, at least, a good beginning; that, under the circumstances, it is not surprising that mistakes have been made or that errors, at first insignificant, should have multiplied as the work of construction progressed. It is only by such practical experience, they say, that anything like perfection can be attained in so difficult and undertaking as that of trying to combine the good qualities of various novel constructions.

In order to better understand the recent criticisms on what has already been accomplished by our naval constructors, and what they have proposed to themselves, it is necessary to have the list of new ships before us. Here it is:

	Displacement.	Guns. Breech loading Rifles.	Speed.	Condition.
Amphitrite	3,815	4 10-in.	12	Incomplete.
Monadnock	3,815	4 10-in.	12	Incomplete.
Terror	3,815	4 10-in.	12	Incomplete.
Miantonomoh	3,815	4 10-in.	12	Incomplete.
Puritan	6,000	4 10-in.	13	Incomplete.
Dolphin	1,500	1 6-in.	15	Complete.
Boston	3,000	2 7-in. / 6 6-in.	14	Armament incomplete.
Atlanta	3,000	do.	14	do.
Chicago	4,500	4 8-in. / 6 6-in. / 2 5-in.	15	Incomplete.
Gunboat No. 1	1,700	6 6-in.	16	Not commenced
Gunboat No. 2	870	4 6-in.	12	Not commenced
Newark	4,000	12 6-in.	18	Not commenced
Charleston	3,730	2 10-in. / 6 6-in.	18	Not commenced
Baltimore	4,400	4 8-in. / 6 6-in.	19	Not commenced
Armored cruiser	6,000	4 10-in. / 6 6-in.	16	Not designed.
Armored battle ship	6,000	2 12-in. / 6 6-in.	16	Not designed.
Pneumatic dynamite gun ship	—	—	20	Not designed.
One first class torpedo boat	—	—	—	Not designed.

The Dolphin is a dispatch boat, not intended for fighting, nor fast enough to overhaul modern merchant steamers. The Atlanta has made 13 knots over the measured mile—a test always made under favorable circumstances—which places her, in point of speed, scarcely ahead of the ancient Iroquois, now 30 years old. Like the Boston, the Atlanta is a nondescript. Each has a battery consisting of two 7 inch and six 6 inch guns, and hence, with their limited speed, frail sides, and inability to carry heavy batteries, have neither the power to fight, the strength to stand assault, nor the ability to run away. Of the Chicago, which is larger than either the Atlanta or Boston, and has not yet been tried, Admiral Porter says: "She contains an absurd mass of machinery. The engines are of the type known as side levers—a cumbrous, friction-generating kind, unfit to put in the hold of a man-of-war. I take upon myself credit for having a change made in the valve arrangement which will better things somewhat. I succeeded in having the plans for poppet valves altered and slide valves substituted The clanking of the side levers will be like the noise of a chain gang. I know of a merchant steamer with a single screw, plying between New York and New Orleans, that has a side lever engine. She is under repairs more than the other ships of the line, although she is fast. For a man-of-war, the Chicago's engines are as bad as can be."

It is but fair to say here that it is not the contractor, as the public is inclined to believe, who is responsible for this kind of work. He only carries out the design placed in his hands. It is the Bureau of Steam Engineering, quoting again from the Admiral of the Navy: "An ax to grind here, a pet hobby there, a patent arrangement yonder, and there you have it. I would not allow the Bureau of Steam Engineering to touch a plan or alter an engine provided by a contractor. It is the incompetency of the designers of the engines, to call it no worse, that leads to such direful results as we have seen."

The Admiral and other authorities who have recently spoken upon the subject believe that private firms should be called upon to design the engines. In other words, they should be expected to furnish engines which would give a certain speed. The rest is easy. If the required speed is not obtained, the ship is not accepted. But when the engines are designed by the department, and the contractor expected to get speed out of them, disaster usually follows. All seem agreed that, to be efficient, a fleet should be composed of three classes: First, commerce destroyers—fleet-footed unarmored vessels, carrying two or three heavy guns; second, armored fighting ships; third, torpedo boats. As to how many of each are required, or the proportion of one class to the other, opinions differ; the majority, however, believing our requirements would be best served by torpedo boats and light-footed, unarmored cruisers. The National Line's steamer America is thought to be a good type of what these cruisers ought to be. She is much broader than the Oregon type, and can steam 17 knots an hour, not only on the measured mile, but continuously through the day's work. The English cruiser Inconstant, also of 17 knots speed, is an admirable specimen of this class, but is thought to be altogether too large and, consequently, too costly for our needs. What would our 13 and 14 knot unarmored ships do in the presence of an Inconstant, which could always choose her target and the most favorable firing point, and get away when the odds were against her? The general opinion of the two 4,000 ton unarmored ships is that they are too large, or, rather, needlessly large.

John Herreshoff, the ship builder of Bristol, Rhode Island, is perhaps as good an authority on speed as there is to be found. He designed and built the Stiletto, undoubtedly the simplest steam yacht afloat. He pins his faith on swift-moving torpedo boats as a main reliance. He says that torpedo boats built on the same lines as the Stiletto, but of steel, instead of wood, and of 150 feet length, could be made to steam a speed of 30 miles an hour. The Stiletto has made 27.

That the swift-moving torpedo boat is likely to take a very important part in the future naval war there can be little doubt. Even the French Admiral Aube and Sir Spencer Robinson, Sir Edward Reed, George Mackron, of the Thames Ship Building Company, Mr. Watts, the constructor at Elswick, and ex-Chief Constructor Warren, of the Chatham Royal Navy Yard, were all spoken to recently on this subject, and either expressed confidence in the efficiency of torpedo boat attack or, if not affirming the proposition, were unwilling to deny its truth.

In view of this, it seems strange that the naval board should have contented itself to advise the construction of "one first-class torpedo boat."

THE DYNAMO COLOSSUS AT WORK.

BY WM. H. HALE, PH.D.

An account of the newly invented process of smelting by the Cowles system of electric furnace was given in the SCIENTIFIC AMERICAN of May 22, 1886 (p. 328). The dynamo Colossus, the most powerful ever constructed, was illustrated and described in the SCIENTIFIC AMERICAN of August 28 last.

On the 16th of September, I had the good fortune to pay a visit to Lockport, N. Y., just in time to find the dynamo engaged in smelting its first run of metal, which was an alloy of aluminum and copper.

Although the process of electric smelting is capable of reducing the most refractory ores, and securing many costly metals, such as potassium, sodium, magnesium, and the like, besides metalloids, boron, silicon, etc., yet the company now aim especially to secure aluminum in large quantities, because of the many valuable properties of that metal and its alloys, and the almost infinite variety of uses and inexhaustibility of demand for them at the reduced price which this process renders possible.

Both the Cowles brothers, Eugene H. and Alfred H., the joint inventors of the electric furnace, were present—the latter having only the day before returned from Europe, where he had been exhibiting specimens of product as previously obtained by smaller dynamos at Cleveland, having secured, among other fruits of his trip, an order from Whitehead, manufacturer of torpedo boats, for 6,000 pounds of the 10 per cent aluminum and copper alloy. No other visitor was present. The big dynamo was running at 380 horse power, though capable of 500 horse power when required. It was making 420 revolutions per minute, and, as the electricity was drawn off, it scintillated in a brilliant and continuous fusillade of sparks varying in color from white to emerald green, and occasionally flashing out in a burst of unusual splendor, yet perfectly controlled and free from danger to the spectators.

The dynamo is driven by water power. The waterways were constructed by Holley, and are replete with ingenious appliances for utilizing all the power there is, and for keeping the water at a uniform level. The water wheels used are double turbine with horizontal shaft, each turbine being eight feet in diameter. The dynamos—for there is also a smaller one—occupy a room by themselves intermediate between the turbine wheel room and the furnace room.

Passing to the furnace room, we see where the energy of the dynamo is being expended. The furnaces are built larger for the Colossus than those used with smaller dynamos, and are charged with 60 pounds granulated copper, 60 pounds corundum, and 30 pounds coarse charcoal, besides the pulverized lime-coated charcoal used as packing. This mixture contains over 32 pounds of aluminum or about 54 per cent of the corundum. Into the furnace thus charged pours the current from the Colossus, fusing the almost infusible corundum like wax, causing its molecular structure to be broken up into its elements, and raising the temperature of the entire mass to a very high heat. Vent holes are left in the covering of the furnace, through which escape the liberated gases and some of the volatilized aluminum, the whole glowing with a bright flame which sometimes darts up to the height of many feet. The amperemeter on the wall shows with what force the current is flowing, and the attendant must watch it closely to keep it at the desired gauge. A force of 2,000 to 2,400 amperes is generally preferred. As the index approaches the higher limit, the carbon electrodes are from time to time drawn asunder, till at last they stand wide apart, and the current flows freely through the entire furnace. The process of reduction takes about two hours.

Returning to the dynamo room, we find at the end of the run that the bearings of Colossus are not raised to the temperature of blood heat; and it proves to be the case that it may be run continuously without becoming overheated, thus demonstrating the excellence of its construction under the personal supervision of Mr. Brush. The bane of dynamos is overheating.

What do we find in the furnace at the end of the reduction? The products of the electrical furnace have furnished the theme for several papers already before scientific societies, and will supply a probably fruitful field of research for time to come. Since the first run of the dynamo, I have on several other occasions visted the works and seen the charges withdrawn from the furnace. The product appears in the form of a fused mass of metal embedded in the surrounding carbon. Most of this mass is an alloy of copper and aluminum, varying much in the proportion of the two. Mostly it exceeds the 10 per cent of aluminum which gives the alloy of maximum strength, and is a brittle white metal, which is again fused with the addition of more copper to such an alloy as may be required.

But the furnace gives many other products. Sometimes there are found small fused rubies and sapphires. The sub-oxide of aluminum—never found in nature, and never before known to exist or to be capable of formation—is always present in larger or smaller quantities. I have also seen specimens of beautiful, white, fibrous alumina. With other charges, sub-oxides of silicon and titanium are found—very curious products indeed. The intense heat even partially fuses the carbon, and the electrodes are converted into graphite.

The rush of visitors has been so great that the company have been compelled to restrict facilities for admission latterly.

Important economical as well as scientific results have been already attained by the dynamo. The price of aluminum alloys has been reduced to a scale adopted by reckoning the value of the contained aluminum at $2.50 a pound, previous sales of that metal having been at the rate of 75 cents an ounce.

The 10 per cent alloy is said to be the strongest metal known, though alloys of a less per cent have great utility, being tougher, but not so strong. Krupp cannon require a tensile strength of 70,000 pounds per square inch of wrought steel, the labor on which raises its cost to 75 cents or a dollar a pound. Some specimens of the alloys made by the Colossus, which are simply cast, not wrought, have recently shown the phenomenal strength of 131,000 pounds per square inch.

Since writing the above, I notice the statistics of production of different metals in the United States for 1885, as given in the SCIENTIFIC AMERICAN for Nov. 6, 1886. In that table the whole amount of aluminum produced during the year is stated as 3,400 oz., aluminum being then regarded as a precious metal.

The capacity of the Colossus will enable it to reduce a larger amount than this, in the alloy with copper, within the period of twenty-four hours.

Alloy of Aluminum and Tin.

A useful alloy of aluminum and tin has been obtained by M. Bourbouze, by melting together 100 parts of the former metal with 10 parts of the latter. This alloy is whiter than aluminum, and has a density of 2·85, a little greater than that of the pure metal, so that it is not too heavy to replace aluminum in instruments requiring great lightness of their parts. It is less affected by reagents, etc., than is aluminum, and also is more easily worked. Another of its merits is that it can be soldered as easily as brass without any special preparation.

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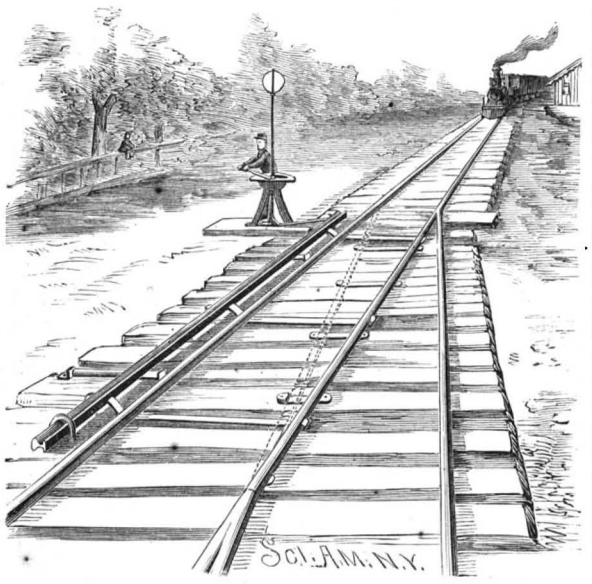
FROGLESS SWITCH.

In the switch herewith illustrated the switching rail is so secured that its butt end rests against the meeting ends of the inner rails of the main track and switch. These rails are so joined together that the end is the same size as that of a single rail. The point of the switch rail is beveled off from each side, so that it will



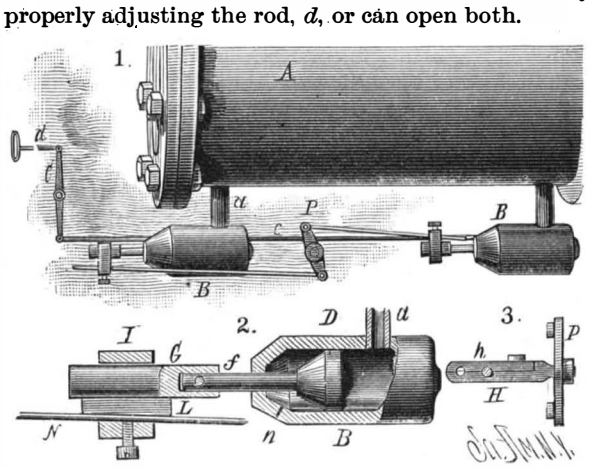
CULP'S FROGLESS SWITCH.

fit snugly against either the outer rail of the siding or against the rail of the main track. This rail is prevented from spreading by two sets of stops, placed as shown in the engraving. Connected with the switch rail by tie rods is a second rail, placed on rollers along the outside of the main track. One end of the second rail is held in place by a staple, while the other end is connected to the lever of a switch stand by a link. The movement of the lever moves the auxiliary rail and the switch rail to the position indicated by the dotted lines, and thereby opens the siding.

This invention has been patented by Mr. Abraham Culp, of Mount Carmel, Pennsylvania.

CYLINDER COCK.

This device is intended for use in connection with the steam cylinders of a locomotive or other form of engine, the object being to provide for the automatic discharge of the water of condensation at each stroke of the piston. Beneath and connected with the cylinder, A, by tubes, *a*, are placed two valve chambers, B, each of which has a bracket, in which the rod, *c*, is loosely mounted. This rod is so connected, by the lever, C, and rod, *d*, as to be within reach of the engineer. The plug valves, D, fit loosely within the chambers, and in the inclined seats are formed apertures, *n*, through which the water of condensation entering the chambers is discharged. The extended ends of the valve stems, *f*, are held in apertures formed in the forward ends of cylinders, G, which are adjustably connected to rod, N, pivoted to a rocker, P, carried by the arm, H, which is clamped to the rod, *c*, by means of the plate, *h*. Steam entering the front of the cylinder, A, passes into the chamber, B, through the tube, *a*, and forces the valve against its seat. This movement of the forward valve throws the rear one away from its seat, and allows the water that was behind the piston to escape through the opening, *n*. The movements are reversed when steam enters the other end of the cylinder. If necessary, the engineer can close both of the valve chambers at the same time by properly adjusting the rod, *d*, or can open both.

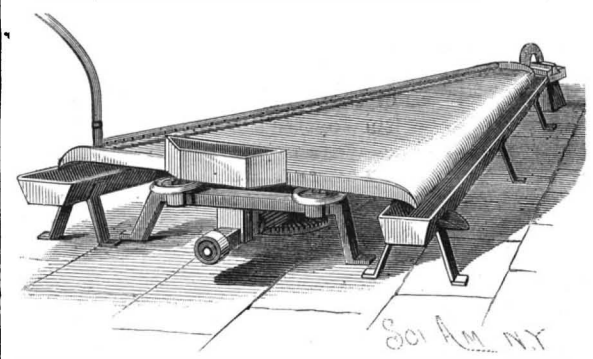


This invention has been patented by Mr. William Stoffel, of McHenry, Illinois.

MIXTURE FOR CLEANING GREASE SPOTS.—Equal parts of stronger ammonia water, ether, and alcohol form a valuable cleaning compound. Pass a piece of blotting paper under the grease spot, moisten a sponge, first with water to render it "greedy," then with the mixture, and rub with it the spot. In a moment it is dissolved, saponified, and absorbed by the sponge and blotter.

ORE SEPARATOR.

By means of the simple machine herewith illustrated, ores of various kinds may be washed and separated, and the valuable mineral and tailings separately and closely graded. The pan is formed of a flat plate, having down-turned aprons at the tail and head edges, and up-turned flanges at the front and back ends. The front end lies about at right angles to the tail, while the head preferably makes an angle of from twenty-five to thirty degrees with the tail. By means of simple mechanism arranged on the frame beneath the pan, the latter is given a horizontal movement. The front end of the pan is provided with fixed bearer feet, which rest loosely on the tops of the large heads of screws threaded into lugs of the frame. By adjusting these screws, the front end of the pan may be raised to give the desired inclination from the front to the rear end, and from the tail corner to the head corner. At the opposite or sharp end of the pan is fixed a bowed arm, at the end of which is swiveled a shoe, sliding in the grooved head of a screw provided with a lock nut. The pan may be thus vertically adjusted to give the necessary inclination from its front end toward its rear end. This method of supporting this end of the pan also provides for giving it a greater or less lateral throw toward and over the mineral box, which is supported under the head of the pan to receive the washed and graded mineral. This is accomplished by holding the groove or slideway of the screw head at any desired angle to the stroke line of the pan. The back ends of the mineral box and tailings box, which is supported beneath the tail edge of the pan, are connected by a conduit, through which excess of water in the mineral box may pass to the other, and thence out through a suitable spout. Water is supplied to the pan from a pipe placed along the head of the pan, the water being delivered in gradually diminishing quantity from the front toward the back end. This graduated water supply allows the coarser and finer ore particles on the pan to be thoroughly washed with a minimum quantity of water; this also prevents the finer valuable ore particles from being washed into the



KRAUSE'S ORE SEPARATOR.

refuse box. The crushed ore is fed to the pan through a box located at the front end, about over the driving shaft. As the pulp flows toward the back end of the pan, the quick movement of the pan toward its highest point will throw the heavier particles in that direction, while the lighter ones will arrange themselves down the slope, according to their weight, and the current will wash all the worthless material into the refuse box, while the valuable mineral will be carried into the mineral box in condition for smelting. Both the tailings and valuable mineral will be graded into different sizes in their respective boxes, and the larger particles of the former may be removed and reduced for subsequent treatment.

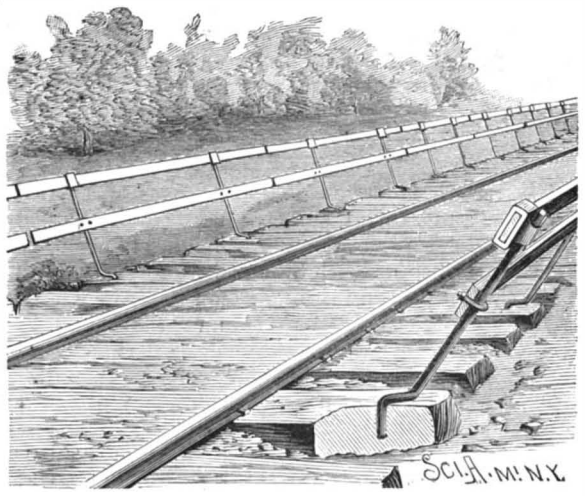
This invention has been patented by Mr. Henry C. Krause, of Lake Linden, Michigan.

Gapes in Fowls.

The fact that the disease known as gapes in poultry is produced by a parasitic worm (*Syngamus trachealis*), which infests the trachea of the birds, was settled long ago, and for most of our recent knowledge of the worm and the disease we are indebted to the prize essay of Pierre Megnin. According to this author, the mature worms and their eggs are coughed out of the throat of the infested fowl, and the disease is spread by its associates picking them up along with their food or by drinking water in which the eggs may have hatched into larvæ. No suggestion is allowed of any intermediate host. Mr. H. D. Walker, in an apparently carefully prepared paper on this subject (Bulletin Buffalo Society Natural Sciences, v., pp. 49–71, 1886) details many experiments which he has tried, and several of them point very strongly to the conclusion that the earth worm may, in many cases, play a part in the distribution of the pest. The embryos have been found living in the earth worm at all seasons of the year, and earth worms from infested localities, when fed to chickens, almost invariably produce the disease. Dr. Walker has also produced the disease in robins, and claims to have found the embryo of the lung worm of calves (*Strongylus micrurus*) in the earth worm.—*American Naturalist.*

RAILROAD FENCE.

This fence is designed to exclude roving animals from the track, and at the same time make available for grazing purposes all that part of the railway property lying outside of the track proper. The lower ends of the fence posts are placed in holes in the ends of the ties, and the upper parts of the posts are bent outward, as shown in the engraving. To each pair of posts are connected rails held by staples or by coupling blocks or heads. The staples are held to the rail and



COOLEY'S RAILROAD FENCE.

post by nuts, and the blocks have eyes to receive the rail and a socket to receive the post and a key which clamps the block firmly to the post. This fence may be erected very quickly, and when dismembered for transportation it occupies but little space.

This invention has been patented by Mr. James A. Cooley, of West End, Knoxville, Tenn.

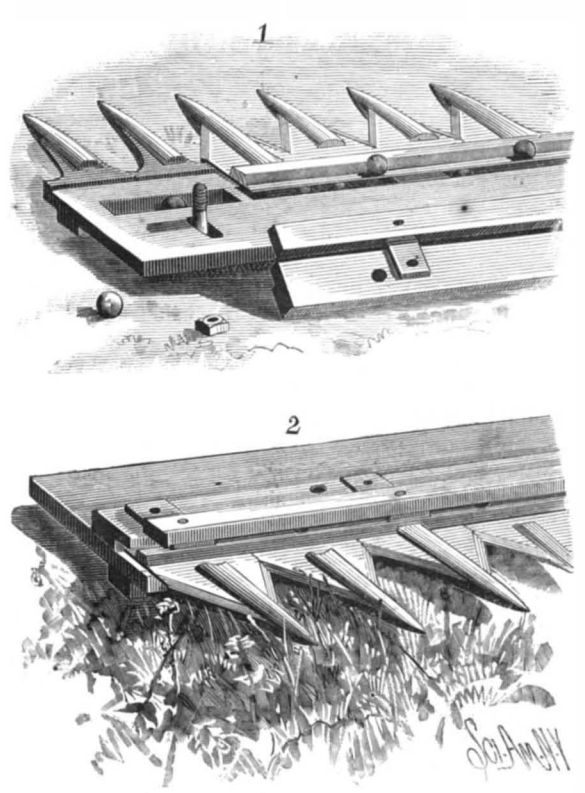
Smelting of Iron Sand.

A method by which the immense deposits of iron sand which abound on the coast of New Zealand can be successfully utilized has lately been discovered at Auckland. The feature of the new process consists in uniting a quantity of scoria with the sand when put in the blast. This has the effect of preventing the iron from oxidizing, an obstacle that has heretofore never been successfully overcome in smelting iron sand.

CUTTING APPARATUS FOR MOWERS AND REAPERS.

The principal feature in this cutting apparatus is the method of supporting the knives between roller bearings. The inner parts of the knife blades rest upon spherical rollers held in suitable grooves. Attached to the upper surface of the blades is a knife bar formed with a rear beveled edge, upon which, and upon the blades, is another series of rollers held in place by suitable grooves. The upper row of balls is slightly in advance of the lower one, so that the front part of the knife is pressed downward and made to cut close to the guards, thereby making it impossible for the knives to choke up. The knives are self-adjusting and self-cleaning, and, owing to the ball bearings, no more power is required to run the knife itself when cutting than when not cutting. The frame forming the grooves for the upper rollers can be adjusted forward or back as may be necessary.

This cutting apparatus is the invention of Mr. John C. Voss, of El Paso, Texas.



VOSS' CUTTING APPARATUS FOR MOWERS AND REAPERS.

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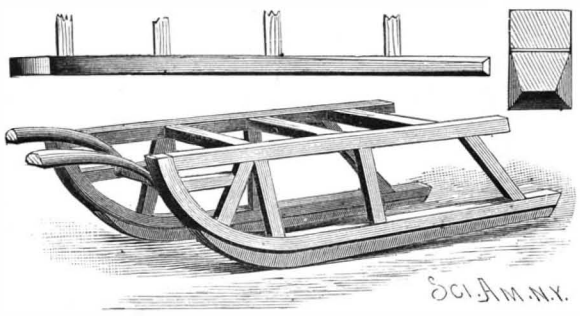
IMPROVED SLEIGH.

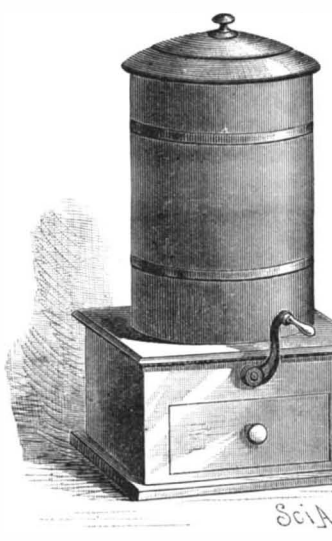
This invention, which has been patented by Mr. Samuel T. Beswick, of Blair, Wis., consists in a diverging construction of the runners relatively to the line of draught. The runners are turned up in front as usual, and are fitted with suitable metal shoes, which are made of tapering width on their bases and with shelving sides throughout the greater portion of their length, being narrowest at their rear ends. The forward portions of the shoes may be made of equal width so that their sides will be parallel with the central line of draught, or the taper may, if desired, extend the whole length of the shoes. In some cases it will be found advantageous to make the base line or surface of the shoe taper upwardly in a backward direction throughout the length of the side taper. This construction of the shoes reduces the friction and allows the rear end of the sleigh to sink somewhat, and so prevent the front end from cutting the snow too deep; the sleigh can also be turned easier, and will keep to the track more readily.



BESWICK'S IMPROVED SLEIGH.

FLOUR CHEST AND SIFTER.

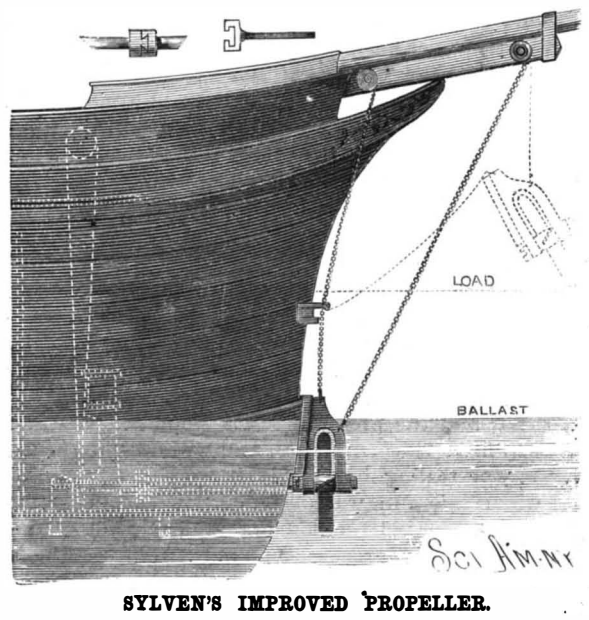
The accompanying engraving represents a flour chest and sifter invented by Mr. H. G. Filson, of New Cumberland, W. Va. Extending across the mouth of a conical hopper secured in the receptacle near the middle is a bar, which supports a central stud carrying a bevel gear wheel formed with two or more arms, and carrying upon its upper surface a sieve, which is near but not in contact with the mouth of the hopper. This gear wheel meshes with a horizontal shaft, one end of which extends through the side of the receptacle and is provided with a crank handle. In the bottom of the receptacle is a drawer, and on the top is fitted a cover. The receptacle is designed to contain a supply of flour. When flour is needed the crank is turned, thereby rotating the sieve and discharging a quantity into the drawer, from which it is taken for use. The cross bar not only serves as a support for the stud, but also as a stirrer for breaking up lumps of flour and causing it to be more rapidly sifted.



IMPROVED PROPELLER.

The propeller herewith illustrated can be attached to either wooden or iron vessels, and is designed as an aid for sailing vessels in a calm. The screw is mounted upon a short shaft, journaled in the lower part of the frame. The inner end of the shaft is formed with a clutch, which connects with a similar clutch on the outer end of a shaft journaled in a bearing in the keel and in a pillow block located within the vessel. At the perpendicular edge of the frame is a T-piece fitting in a flanged guide attached to the keel for holding the propeller in proper position. When not in use, the propeller is carried upon deck, and is raised and lowered by means of two chains arranged as shown in the engraving. A simple device is provided for guiding the T-piece of the frame, so that it will easily enter the guide, while a lip formed at the bottom of the socket prevents the propeller frame from dropping too far. The inner end of the main shaft is provided with a pulley, over which passes a belt leading over a pulley on deck. When the latter is revolved by any suitable hand or other power, the screw is turned to propel the vessel. A stop spring is adapted to spring over the upper end of the T-piece, and lock the propeller in the socket. This spring may be drawn out to release the propeller, by means of a cord reaching to the deck. It will be noticed that when the propeller and its frame are lifted on board, nothing is left in the water to make any resistance or cause fouling.

This invention has been patented by Mr. W. T. Sylven, whose address is care of Messrs. William Cramp & Sons, Beach and Norris Sts., Philadelphia, Pa.



SYLVEN'S IMPROVED PROPELLER.

REVOLVING TARGET.

The revolving target herewith illustrated is the invention of Mr. W. H. Adams, of Fort McIntosh, Laredo, Texas. Framed into the main post, which is mounted upon an upright metal spindle secured to the base of the target, are cross arms of equal length, and the ends of which are slotted to receive the upper and lower horizontal arms of the target frames, to which are secured the plates on which the bull's eye and rings of the target are painted. The revolving portion of the target is locked in place to hold one of the plates in position to receive the shot, by a spring secured upon the base, and provided with a rod by which it may be depressed to disengage the target by a foot bar extending to a shelter behind which the target tender stands. This target is easily constructed and durable, and the frames may be readily removed and replaced when the plates require renewal.

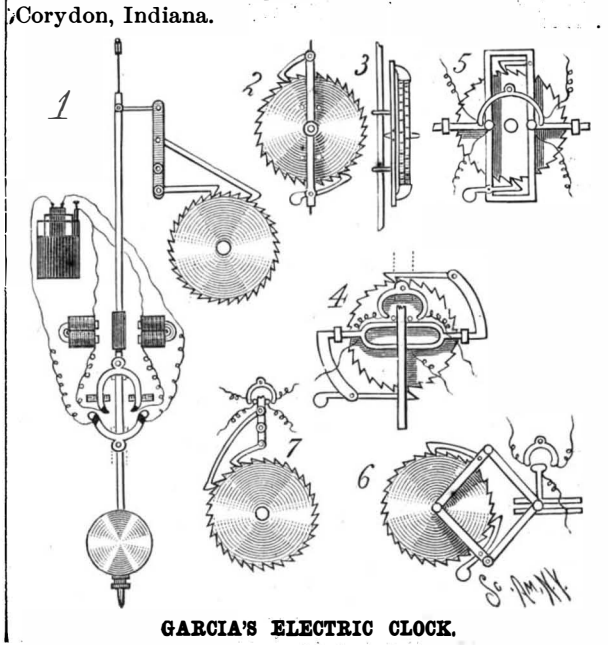
ELECTRIC CLOCK.

The clock herewith illustrated is constructed with two toothed wheels on the same shaft, one wheel having one or more teeth than the other, and both being operated by the same pawls, so that one is moved faster than the other; and by means of hands the relative positions of the wheels and the time are indicated. On the pendulum rod, Fig. 1, is an armature interposed between two electro-magnets connected by wires with one pole of a battery and with contact pieces on the ends of the shanks of a U-shaped anchor pivoted to swing on a suitable fixed support. These contact pieces are interposed between and arranged to be struck by contact plates near the free ends of an inverted anchor, also pivoted on a support, the plates being connected by wires with the other pole of the battery. In the shanks of the upper anchor are adjustable screws, which are alternately struck by the swinging pendulum rod.

With this construction, when the pendulum starts to swing to the left, it strikes the left-hand screw, and throws the corresponding contact piece on the upper anchor against the contact plate on the lower one, thereby closing the circuit through the left-hand magnet, which attracts the armature and gives the pendulum an impulse to the left, accelerating its motion slightly, until the contact piece slides off the plate and on to the non-conducting tip of the lower anchor. The circuit is thus broken and the pendulum allowed to swing by its own gravity to the right, when a similar impulse is imparted to it. The motion of the pendulum is thus maintained constant.

Attached to the upper part of the pendulum is a rod secured to a lever provided with two pawls connected one above and one below its pivot. The motion of the pendulum causes the pawls to engage alternately with the teeth of both wheels, which are thereby revolved. These pawls may be arranged in different ways, as shown in Figs. 2, 4, 5, 6, and 7, Fig. 3 being an edge view of Fig. 2. The pawls act alternately, and each one always acts upon both wheels, so that when one wheel is revolved the other is revolved with it; and as one has less teeth than the other, it is evident that when the larger wheel has completed one revolution, the smaller has made one revolution and a few teeth more. The numbers of the teeth are such that the relative movements of the wheels will take place in times corresponding to the subdivisions of time into hours, minutes, and seconds.

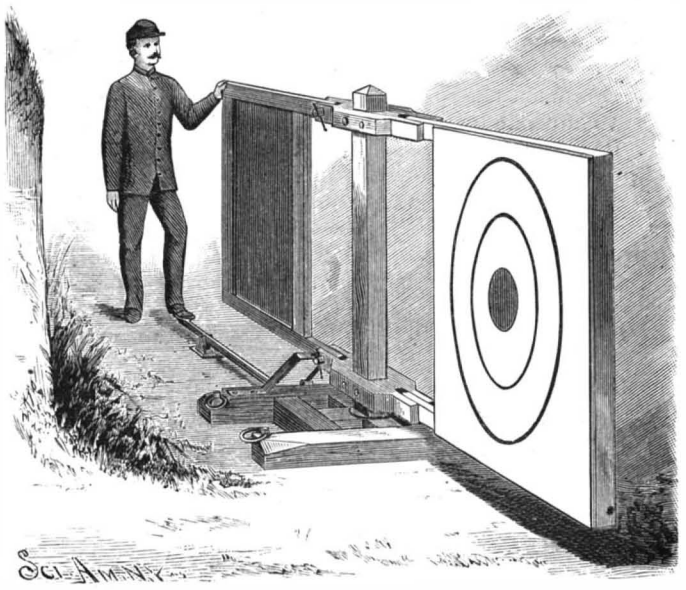
This invention has been patented by Mr. D. T. Garcia; particulars can be obtained from Mr. G. Castanos, of Guadalajara, Mexico.



GARCIA'S ELECTRIC CLOCK.

Dental Caries in Bakers.

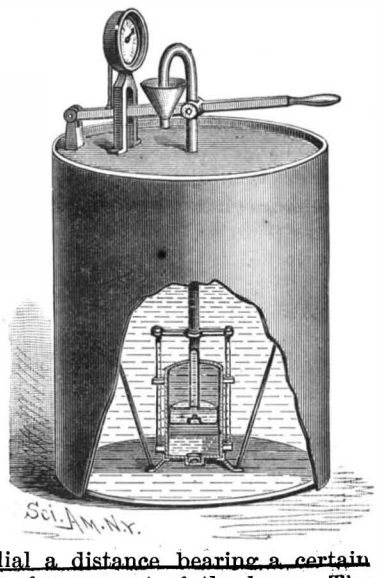
Professor Dr. Hesse, of Leipsic, in the *Deutsche Monatschrift*, points out the deplorable condition of the teeth of bakers, and says that he is often able to tell the profession of the patients by the condition of their teeth. The caries is soft and rapidly progressive. The principal parts attacked are the labial and buccal surfaces of the teeth, commencing at the cervix and rapidly extending to the grinding surface. The approximal surfaces do not seem to be attacked more than in other patients. He believes the disease to be due to the inhalation of flour dust, the caries being caused by the action of an acid which is formed in the presence of fermentable carbohydrates.



ADAMS' REVOLVING TARGET.

MEASURING PUMP.

The measuring pump herewith illustrated will pump one-half a gallon or any desired fraction of that amount at each stroke. The pump is secured at the bottom of the tank by braces, and is provided with a hollow piston head and tube which is connected to the operating lever placed on top of the tank. To this lever is connected, by a rod, a measuring device or register, so that the up and down movement of the lever will move the pointer in front of the graduated dial a distance bearing a certain ratio to the distance of movement of the lever. The dial is graduated in pints, quarts, and gallons, according to the capacity of the pump. The mechanism for operating the pointer is very simple in construction, and reliable. The upper, curved end of the pipe is attached to a funnel for directing the flow of liquid into any receptacle. To draw any desired quantity of liquid, the lever is raised until the pointer indicates the desired quantity on the dial, when the lever is simply forced down, which will cause the exact quantity to be thrown out by the pump.



Further particulars concerning this invention may be obtained from the patentee, Mr. W. B. F. Sims, of Corydon, Indiana.

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Slag Cement.

The possibility of using the slag or scoria resulting from the smelting of iron and other metals for the production of cement, is an idea that has presented itself to many inventors, and has engrossed a vast amount of time, hitherto with very little practical result. We read that this subject has attracted the attention of "several cement manufacturers on the Tyne banks," and that experiments are being made "to utilize the residuals from the blast furnaces in making Portland cement of higher quality than that produced by the ordinary process." A short time ago the Middlesbrough ironmasters spent a good deal of money in similar attempts, and before that we were assured that Mr. Ransome had succeeded in turning various descriptions of slag to profitable account in the preparation of cement said to be superior to Portland cement. So far, however, the new cement has made but little impression on the market, and we are almost despairing of its ultimate introduction. To the superficial observer this problem is doubtless an attractive one. Portland cement, even in these days of competition and low prices, is a relatively costly material, and iron slag is a drug upon the market, and a commodity which some people have even to pay to get rid of; and if, indeed, by some simple process we could convert these millions of tons of scoria into cement, not only would the production of iron become cheaper than ever, but the manufacturers of Portland in the ordinary way would have to close their works, while, with cheaper cement, one more excuse for bad mortar and jerry building would be removed.

So far, however, the would-be inventors, though they may have been skillful chemists, have shown themselves singularly unable to deal with the chemical facts involved in the production of Portland cement; and though we have to some extent considered the chemical aspects of this question on previous occasions, it may, perhaps, not be amiss to remind our readers, and those who take an interest in this important subject, of certain facts which militate sadly against the employment of slags for the manufacture of Portland.

The double silicates of lime and alumina, burned to the point of incipient vitrification to form the clinker of Portland cement, vary but little in composition, no doubt, from the fused mass drawn from the blast furnace. Indeed, certain of the "basic slags" resulting from the recently introduced processes of Messrs. Gilchrist and Thomas are, chemically speaking, but little different from Portland clinkers; but, as every practical cement maker is aware, there is all the world between a properly burned clinker and one in which the firing has been pushed too far, and which has become, as the term is, slightly "blued." Very hard burned clinker is a most treacherous and dangerous material; not only does it tear the stones all to pieces to grind it, but it resists the combination with water, and becomes hydrated either very slowly, or, if the clinker was actually fused, not at all, while a very small proportion of overburnt clinker will, if it be not picked out, spoil the contents of an entire kiln. The reason for this clearly is that what we have to prepare is a double silicate, capable of hydration, that is to say, capable, when reduced to a fine powder, of entering freely into combination with and of solidifying a certain proportion of water, and of thus binding together the particles of stone, gravel, sand, etc., with which the cement is employed. When the silicates have been fused, or "dead burned," we get a crude glass, as little capable of becoming hydrated on admixture with water as so much sand would be, or we obtain, perchance, a large proportion of these inert silicates, mixed with a quantity of feebly hydraulic silicates of a most dangerous and unreliable character, some of which will inevitably "blow" in the work, *i. e.*, combine with water only after the surrounding particles have set, and have become more or less indurated.

It is, of course, well known that molten slag, when run into water, is mechanically reduced to a very fine state of subdivision, and the silicious particles thereby produced have long been used in place of sand. Some slags, also, when exposed to the action of the atmosphere, will "weather" or crumble, owing to some slow decomposition of the silicates, and to the presence of iron in small quantities. We have yet to learn that the decomposition of slag could be at once effected by any chemical means, which should, as is stated in the article from which we quote, "reduce it to its elements of silica, lime, and alumina" in an uncombined form. Such a chemical discovery would indeed be one of marvelous significance. Many years ago, while this plan of making Portland cement from slag was unthought of, it was proposed to add to molten slag an excess of slaked lime, in the belief that it might be possible in this way to produce hydraulic limes at a cheap rate; but the difficulties of introducing the lime, and of causing it to become thoroughly and intimately mixed with the slag, were found to be insuperable, and the silicates produced were, even with a large excess of lime, extremely insoluble.

Strangely enough, though the ordinary varieties of slag are so inert in themselves, they have some of them the power of rendering hydraulic substances, with which they are suitably mixed, even more hydraulic, and of stimulating in this way chemical action; and it has been proved by Dr. Michaelis that it is possible to improve a good sample of Portland cement by adulterating it with a small proportion of crushed slag. That this action is not simply a mechanical one is proved from the fact that other inert substances have not a similar effect, and it is contended, therefore, by a certain section of the authorities in Germany that an adulteration which tends to improve the compound is not an adulteration, and that the addition of slag to Portland cement should be permitted. This manner of employing blast furnace slag is, of course, wholly different to that contemplated by the Newcastle cement makers, but it is worthy of consideration by those who have undertaken the experiments on the Tyne.

The question of the preparation of cement from slags turns upon the solubility or otherwise of the silicates. An insoluble silicate is manifestly incapable of being rapidly acted upon by water, and of undergoing any such rearrangement of its particles as takes place during the "set" or hydration of a sample of Portland cement. The German gentleman who has proposed to reduce slag into its elements must also undertake to recombine the silicic acid with the lime and alumina in a form capable of gelatinizing when treated with acid, and this, we fear, he will fail to do without exposing them to a good red heat—a costly matter to obtain, as the cement maker full well knows. The saving to be effected by the use of the new process would in this event be that only of the cost of the raw materials, less the expense of reducing slag into its elements (which surely cannot be done for nothing), and in this case the cement makers elsewhere need not alarm themselves. If, on the other hand, the German patentee has discovered a means of detrifying slag, and of giving us a compound which requires no firing and which grinds itself, and all this as a sort of supplement to the reduction of the aforesaid molten slag into its elements, we can only say that his invention is one of the most wonderful we have ever even dreamed of.—*G. R. R., Building News.*

The Charleston Earthquake.

The earthquake which visited the eastern part of North America on August 31 was one of the most remarkable in our history, both in its extent and in its serious results to the southeastern portion of the country. Its occurrence naturally excites inquiry as to the possibility of our being more frequently visited than heretofore by this scourge. The numerous earth trembles common to all countries are of little moment, but against such destruction as has visited Charleston we must, if possible, provide.

It is well known that there are lines of abrupt change of the geological structure of the earth's crust, which are known as faults. These are more or less elongated fractures, on one side of which the strata occupy a much higher position than they do on the other. The depressed side may not receive deposits of much thickness subsequent to the fracture. If in this case the elevated side is not removed by erosion, a range of monoclinal mountains is the result. If, on the other hand, deposits are laid down on the depressed area, and the elevated tract is mowed down by "frost and fire," the mountain range disappears, and none but the geologist can detect the fault or fissure.

The shrinkage of the earth is supposed to have been the cause of the elevation of many mountain ranges, which are wrinkles, of the surface. In the formation of these wrinkles, faults often occur. In the formation of the greatest changes of surface, they are nearly always produced. Such abrupt changes of structure occur at or near the sea borders of most continents. The depressed region is occupied by the sea and by the deposited material which flows into it from the shore.

Such a line of fault extends throughout the Eastern United States. It commences at the sea coast of Staten Island, and extends southwest to Trenton, Philadelphia, Wilmington, Del., Baltimore, Washington, Richmond, Raleigh, Columbia, S. C., etc. This is a very important line in the economy of the country. Here the hill country ceases and the plain of the seaboard begins. In many of the States it marks the head of tidewater and of navigation. It is here that the most important cities of our Atlantic States have been built. The presence of water power or of tidewater, or the conjunction of both, has determined their location. Other conveniences make them desirable dwelling places. Such is the equal accessibility of the fruit and vegetable products of the plains with the grazing and dairy products of the hills. Such the equal accessibility of sea shore and elevated places of summer resort. Professor Cope pointed out this interesting geological position of our Eastern cities several years ago.

The position has, however, the disadvantage of being on the line of fracture of the border of the continent. This line is the hinge on which the flatter region of the coast has in past geological ages moved up and down. Many times this region has been submerged, and as many times it has been elevated above the sea level. More than half of it in the latitude of New Jersey, that is, a width of one hundred miles, is submerged at the present time. Its sea border from New Jersey to Florida has been slowly creeping westward, since observations began to be made on our coast. The most exact of these observations have been made by Professor George H. Cook, on the coast of New Jersey. Geologists know that the present state of affairs is not a permanent one. There is no reason to doubt but that the line of fracture referred to may not again become the coast line, or, on the other hand, that the width of our coast region may not be extended one hundred miles out to sea. The plains of this region will then be submerged or elevated. In the former case, if the process be rapid, the loss of life will be great. But it will probably be slow, with occasional slips of one side of the old faults on the other, which will jar the rocks over large areas. Under these circumstances there is no reason to suppose that our region can continue to be exempt from earthquakes. We are to expect periods of repose alternating with periods of disturbance.—*American Naturalist.*

Annual Fair of the American Institute, New York.

Although this exhibition has now been open about six weeks, the crowds in attendance every afternoon and evening show no diminution. Those who have been frequent visitors to the fair in former years generally want to go at least once with each recurring season, while strangers never fail to find much that is entertaining and instructive. The silk loom is this year weaving handkerchiefs on which the New York and Brooklyn Bridge is represented, and they are very much sought after by out of town visitors. The ice-making machines, with their frost-covered pipes, look refreshingly cool, and a large proportion of the passers-by are constantly putting their hands on the icy conductors to satisfy themselves that the ice is real; printing presses are at work on large sheets of advertisements; the workman who is moulding clay into vases, jugs, bowls, and all sorts of pottery has an interested crowd at all times around him; near the man who is noisily selling the potato parer are two Stiles & Parker presses at work stamping out of sheet metal the knives for making the parers. In the woodworking department tobacco boxes are being made, and a great variety of fancy wood articles; sewing machines and attachments fill a considerable space, and the work of fancy stitching and embroidering is practically illustrated by deft manipulators of the various improved devices represented; diamond cutting, as practically shown, always has a crowd of curious onlookers, and the exhibitors of power hammers, stone breakers, and other noisy machinery are frequently starting up their appliances as the crowd happens to gravitate in their neighborhood. There is a full exhibit of the Pierce well drilling machines, the Delamater small pumps and engines, and the New York trade schools of Mr. Auchmuty show some very creditable work in plumbing, wood carving, and carpentry executed by the students. Among the most noteworthy of the exhibits is that of the Ball Electric Light Company. The Ball dynamo has two armatures, each of which rotates within the inductive influence of only one pole of a field magnet, and it has made a wonderfully good record within the four years since its introduction. Mr. Charles Wager Hull, the general manager of the exhibition, has now had so many years' experience in the conduct of these fairs that everything connected therewith proceeds with almost the regularity of an established business, to the satisfaction alike of exhibitors and the public.

The New Eight-Inch Thirteen-Ton Gun.

The Ordnance Department is much pleased—the *Army and Navy Register* says—with the performance of the new 8 inch steel gun at Sandy Hook. "This gun, which weighs 13 tons, and whose length of bore is 30 calibers, was manufactured at the West Point Foundry. The tube and jacket were obtained from Whitworth, and the hoops and the breech mechanism forgings from the Midvale Steel Company. The gun was first tried with the German brown prismatic powder, when the following results were reached: With a charge of 100 pounds, and with a shot weighing 182 pounds, the muzzle velocity was 2,145 feet, and the pressure 29,500 pounds; with a 235 pound shot the velocity was 1,942 feet, and the pressure 32,250 pounds; with a shot weighing 286 pounds the velocity was 1,795 feet, and the pressure 32,800 pounds. The gun was next tried with Du Pont's brown prismatic powder, the charge being the same. The velocity with a 235 pound shot was 1,937 feet, and the pressure 32,950 pounds; with a 286 pound shot the velocity was 1,820 feet, and the pressure 35,450 pounds. The gun has been fired thirteen times, and will now be turned over to the testing board. It is worthy of remark that when this gun was designed, the computed velocity with the 286 pound shot was 1,825 feet, and the computed pressure 36,000 pounds. This is almost exactly verified by the firing with the Du Pont powder."

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Correspondence.

A Preservative Wanted.

To the Editor of the Scientific American:

One firm in our town has sold for grape covers, in raisin making, during the past two months 42,000 yards of heavy cotton cloth (Cabot A brand). Of course, many thousand yards were in previous use, and increase of acreage will necessitate further large expenditures in this direction in the future. Now, it would be of great value if some one could give us a cheap, effective, unrotting preservative for this vast amount of cotton cloth, which we nightly spread over our grapes during the rasin making season. Who will be this public benefactor? D. EDSON SMITH.

Santa Ana, Cal., Oct. 27, 1886.

An Incident Pertaining to the Earthquake at Savannah.

To the Editor of the Scientific American:

In your last issue of the SCIENTIFIC AMERICAN you quote from Professor John S. Newberry, who, in his lecture, said that "an earthquake wave coming from below often exerted its greatest force on the surface, as in the game called by boys snapping the whip." This, I think, finds direct verification in the following fact:

On the morning following the 31st of August shock at Savannah, the weathercock (in form an arrow) on the spire of the "Independent Presbyterian Church" was seen to be bent, not in the middle, but nearest to the arrowhead.

The church is a very solid granite structure. The top of the spire is 223 feet from the ground, slender and graceful, and suggestive of elasticity. With the exception of some cracks in the ceiling, there appears no damage to the building.

It is difficult to understand why the arrow did not bend at point of contact with the lightning rod on which it revolves. WM. L. WAKELEE.

Savannah, Ga., Oct. 30, 1886.

Large Railway Maps.

To the Editor of the Scientific American:

During my last trip in Europe, I noticed the use made by railroad companies of large wall surfaces in their stations for charts of the railroad system to which the station belonged, and also other connecting lines, or, in one instance, in the depot of the Kaiser-Ferdinand railroad at Vienna, showing Middle Europe, with all railroad and steamboat lines on a large scale, which I found very convenient to myself and fellow travelers, for selecting best routes to different places.

These charts are made, printed, and finished to the wall as common wall paper, and furnished by a large wall paper firm.

This, I think, would also be of great value to the traveling public of this country, and as an advertisement to the railroad companies, in large stations where great halls and waiting rooms offer bare wall surfaces, which at the same time would be ornamented by such charts. A. GARTNER, C.E.

Savannah, Ga., October, 1886.

Dietetic Fallacies.

1. That there is any nutriment in beef tea made from extracts. There is none whatever.

2. That gelatine is nutritious. It will not keep a cat alive. Beef tea and gelatine, however, possess a certain reparative power, we know not what.

3. That an egg is equal to a pound of meat, and that every sick person can eat eggs. Many, especially those of nervous or bilious temperament, cannot eat them; and to such eggs are injurious.

4. That, because milk is an important article of food, it must be forced upon a patient. Food that a person cannot endure will not cure.

5. That arrowroot is nutritious. It is simply starch and water, useful as a restorative, quickly prepared.

6. That cheese is injurious in all cases. It is, as a rule, contra-indicated, being usually indigestible; but it is concentrated nutriment, and a waste repairer, and often craved.

7. That the cravings of a patient are whims, and should be denied. The stomach often needs, craves for, and digests, articles not laid down in any dietary. Such are, for example, fruit, pickles, jams, cake, ham or bacon with fat, cheese, butter, and milk.

8. That an inflexible diet may be marked out, which shall apply to every case. Choice of a given list of articles allowable in a given case must be decided by the opinion of the stomach. The stomach is right and theory wrong, and the judgment admits no appeal.

A diet which would keep a healthy man healthy might kill a sick man; and a diet sufficient to sustain a sick man would not keep a well man alive. Increased quantity of food, especially of liquids, does not mean increased nutriment, rather decrease, since the digestion is overtaxed and weakened. Strive to give the food in as concentrated a form as possible. Consult the patient's stomach in preference to his cravings; and if the stomach rejects a certain article, do not force it.—*Journal of Reconstructives.*

DECISIONS RELATING TO PATENTS.

U. S. District Court.—Northern District of Illinois.

WETHERELL *v.* KEITH *et al.*

Blodgett, J.

In order to defeat a patent on the ground of prior use, such use must be established beyond reasonable doubt. (*Coffin v. Ogden*, 18 Wall., 120; *Washburn & Moen Manufacturing Company v. Haish*, 4 Fed. Rep., 900.)

Where a witness testified to his use of a patented invention sixteen years before the time when he testified, and that he employed some ten persons in its manufacture, and yet could not tell the names of any of such persons, *held* that his testimony failed to make out a defense.

Two witnesses testified in 1884 to seeing the patented device in use in 1864; but their testimony was indefinite and contradicted in many important particulars, and none of the alleged prior devices were produced. *Held* insufficient to defeat the patent.

Letters patent No. 116,411, granted June 27, 1871, to Charles C. Carpenter for an improvement in hoop skirts, sustained over the alleged prior use by Max Schwab, at Ottawa, Illinois, and that seen by Robert G. Lester and August Seligman in 1864.

Appellate Court.—First District of Illinois.

WOLLENSAK, APPELLANT, *v.* BRIGGS, APPELLEE.

Bailey, P. J.

The bill in this case is to compel the specific performance by the defendant of certain contracts between him and the complainant. By these contracts the defendant undertook to produce and construct by his labor, skill, and inventive genius certain improved machinery for manufacturing speaking tubes. Said machines, as the bill alleges, were to embrace and embody various new and useful improvements and inventions made and to be made by the defendant. No details or specifications are given in the contracts as to the form, material, structure, principle, or mode of operation of the proposed machines, all these matters being left wholly to the judgment and discretion of the defendant. Indeed, it is difficult to see how it would have been possible to give any specifications and details of the machines, as some, and perhaps many, of them had as yet no existence in the minds of the contracting parties, but were to be invented and developed by the defendant by means of subsequent thought, study, and experiment.

There are at least two insuperable reasons why these contracts cannot be specifically enforced in equity. The first is that courts of chancery will not entertain bills to compel the specific performance of contracts for personal services. Especially is this true where the services stipulated for require the exercise of mechanical skill, intellectual ability, and the exercise of judgment. Although some cases may be found in the earlier reports holding contrary doctrine, the rule as we have stated it is now well settled.

. . . . If a court of equity should attempt to order a specific execution of the contract in this case, it is manifest that insurmountable obstacles would immediately present themselves. It would be impossible for the court to specify or describe in its decree the machines to be constructed, their form, material, or structure, or if it attempted to lay its mandate upon the defendant to proceed with the invention and construction of the machines stipulated for, it could never know with certainty whether its order was obeyed. If it should attempt to take the execution of the contract into its own hands, it would be met with equal difficulties. Its officer charged with the performance of its decree would be powerless. The court would thus find itself unable to either compel the defendant to execute the contract or to cause it to be executed through any of the agencies by means of which courts of chancery ordinarily enforce their decrees.

U. S. Circuit Court.—Northern District of Illinois.

RACINE SEEDER COMPANY *v.* JOLIET WIRE CHECK ROWER COMPANY.

Blodgett, J.

In a suit for infringement of the fourth claim of Letters patent No. 76,903, of February 21, 1868, for a broadcast seeder, the only proof as to the kind of machine made by the defendant was the testimony of a witness that the defendant was making a seeding machine with two feeding holes and a disk. *Held*, "this proof does not make even a *prima facie* case of infringement without proof showing that the feeding holes and disk in defendant's machine perform the same function as those covered by the fourth claim of the Floyd patent."

Assignment of Patent.—Where a party owning the title of record to a patent for over six months conveyed it for a valuable consideration to a corporation competent to purchase and hold it, and whose title was made a matter of record in the Patent Office, *held* that this title could not be attacked for fraud in the assignor to the corporation.

S. claimed that a bank had, against instructions, delivered a deed to a patent without payment of purchase money, instead of holding the deed as collateral to secure a note given in payment. It appeared that S. knew of the action of the bank, but took the note and discounted it. *Held*, that S. could not be allowed, even against his immediate assignee, to treat the deed as having been obtained by such fraud as would vitiate it.

Personal License under a Patent not Assignable.—S. empowered H., by contract in writing, as his lawful attorney, to sell rights under a patent, at prices to be approved by S., for the then unexpired term of the patent, and authorized H. to manufacture under the patent at a certain royalty, but reserved the power to revoke the contract in case H. should not faithfully perform his agreements under it. *Held*, that the contract both as a power to sell and as a license was a merely personal one, and not transferable by H. except with the consent of S., and that when S. parted with his title to the patent he parted with his right to sanction or vivify any assignment from H.

Volcanic Dust.

The California State Mining Bureau and the California Academy of Sciences have both received samples of the dust, or ashes, ejected by the more active volcanoes of Pabloff, situated west of Pabloff Bay, Alaska. This volcano has been more or less active for years—perhaps for centuries; but on the 12th of August last put forth all its strength about 6 A.M., and sent cinders and ashes a wondrous distance skyward. Some of these were collected and sent here. Wm. Attwood, who examined the specimens sent to the Mining Bureau, states that there are indications of some magnetic substance.

Captain John Ross, of the schooner Unga, was fishing off Unga settlement on the morning of the eruption, and saw what appeared to be a fast-rising thunderstorm to the westward. This was the more remarkable, inasmuch as thunder is very rare in that region. Yet it was so like an electric-laden mass that neither the captain nor his companions doubted for a moment its aerial character, and to further convince them they heard a continuous rumbling between 7 and 8 o'clock, with several loud roars resembling distant claps of thunder.

The mass was slowly moving eastward, and at 9 o'clock it was over and around the vessel, darkening the sky considerably, and so thick that they could not see the land, though but a mile off the shore. They expected rain, but none came, and the air remained crisp and dry. For a time they were at a loss how to account for the phenomenon. After a while, however, some of the men would blink and shake their heads, and assume a questioning mien; then another and another, until all hands were winking and sneezing. Finally, some one discerned minute particles resembling emery on his clothing, and they discovered the character of the "dry rain."

The sky began to clear about 2 P.M., and in the evening the air was clear and the sky bright. From where they lay at anchor, the volcano was distant about 65 miles. The captain has heard that ashes fell to the eastward, off and on Kodiac Island, in plenty. —*Min. and Sci. Press.*

A Torpedo Cannon Ball.

The *Avenir Militaire* gives us some particulars concerning a torpedo cannon ball invented by Captain Coudray, of the navy. Four years ago the captain presented his projectile to the authorities, who at once ordered experiments to be made with it at Gaves, near Lorient. We are told that for some time past the modest inventor has been engaged in manufacturing his projectiles under the supervision of a special commission named by the Minister of Marine. At first it was found that all the projectiles discharged at the mean velocity of 150 meters a second rebounded on striking the object at which they were fired. Time was afforded to Captain Coudray to improve his invention, and it seems that, in spite of much head shaking on the part of the *savants*, he has succeeded in curing the defect complained of. The torpedo cannon ball, we are assured, now travels at the rate of 300 meters a second, and instead of rebounding on striking a ship, glides along its side, and never loses contact until it explodes. The last cannon balls constructed contain a charge of 40 pounds of guncotton, although 25 pounds is said to be sufficient to blow up the biggest vessel. It is stated that these projectiles can be fired to a much greater distance than the Whitehead.

Industrial Exhibition at Venice.

The site of the exhibition which is to be opened in Venice on April 25, 1887, is in the public garden at the end of the Quai des Esclavons. The building will have an area of about 6,000 yards, and it will be occupied by painting, sculpture in marble, bronze, and wood, mosaics, glass, and all kind of work that can be considered as related to art. The modern plan of eking out the interest by means of concerts, games, fireworks, etc., is also to be adopted; and as the exhibition is to remain open for six months, a great many people are likely to select Venice as the region for next year's holiday.

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A GIGANTIC KITE.

After remaining for a long time an object of amusement merely, the kite is becoming one of study for the mechanician, who finds in it a means of applying and verifying formulas relating to the resistance of the air, and of thus contributing to the progress of the difficult and complicated problem of flight. So we believe it will be of interest to give a summary of two recent studies—one of them purely scientific and relating to the theory of the kite, and the other an experimental one, in which the author succeeded in raising from the ground a gigantic apparatus, powerful enough to carry a weight equivalent to that of a man.

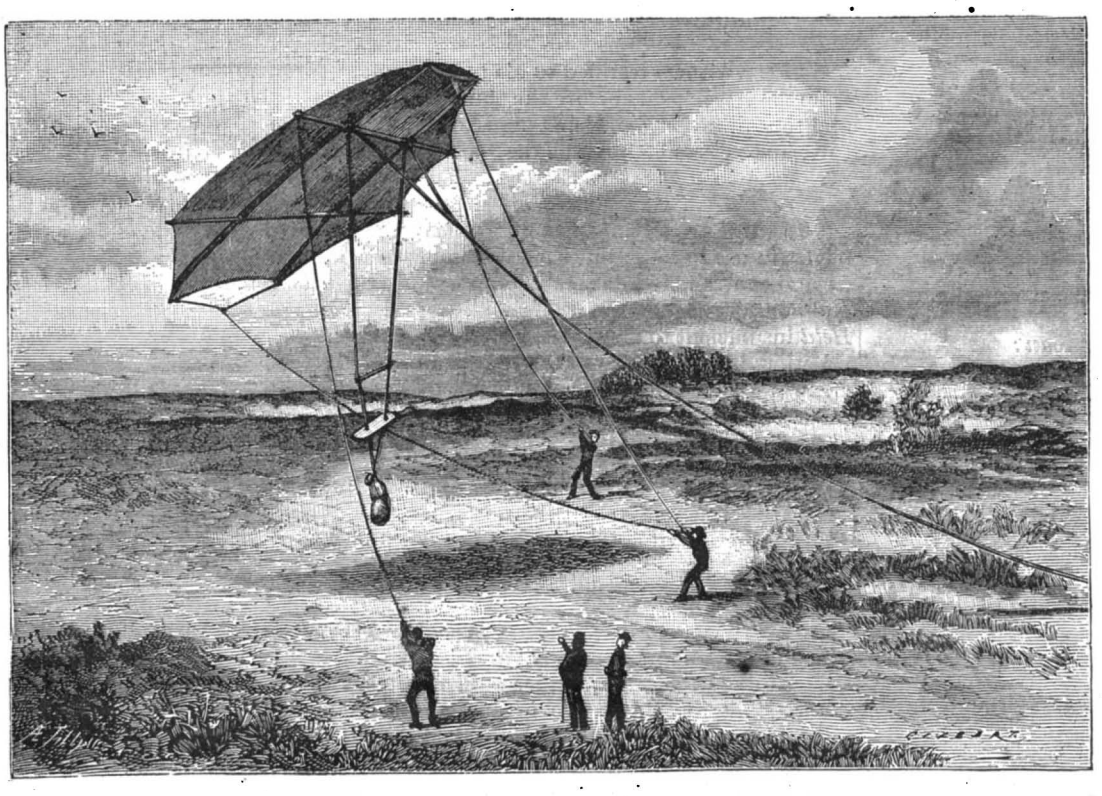
In a communication to the French Association for the Advancement of Science, at the meeting held at Grenoble, in 1885, Mr. J. Pillet, teacher of machinery drawing at the Polytechnic School, presented a very simple and elegant theory as to the equilibrium of the kite, and deduced therefrom certain general principles that may be useful to some of our readers as a guide in the construction of this affair.

In a kite, the elements to be considered are its weight, P; its plane surface; the position of its center of gravity, which the trial has the effect of bringing very near the lower extremity; the center of the wind's pressure, which, as a general thing, is confounded with the geometrical center; and, finally, the point of attachment of the string.

Theory indicates that it requires a certain ratio between the position of the center of gravity, the center of pressure, and the point of attachment of the string, in order to obtain with a given kite a maximum of altitude and of ascensional force. The point of attachment should be upon the straight line passing through the centers of pressure and gravity, higher than the center of pressure, and so that the distance from the center of gravity to the same point of attachment of the string shall be triple the distance from the center of pressure to the same point of attachment. A calculation of the tension of the string in a properly constructed kite shows that such tension varies between very narrow limits only, whatever be the velocity of the wind. In a light wind, all that the string does is to hold the kite, which hangs vertically, and the lower value of the tension is then equal to the weight, P, of the kite and its tail. In an infinitely swift wind, the upper value of the tension of the string is equal to 2 P only. This weight represents quite a feeble tension, and one which even quite a fine cord could easily withstand. Consequently, when the kite is pulling very strongly, this proves that it is badly attached, and not, as one is tempted to suppose, that it is prepared to rise well.

We trust that Mr. Pillet will complete his study and let us know the considerations that he has drawn from it relative to the best form to give a kite, as well as the consequences relative to the problem of flight. The note presented at Grenoble stops at the principles that we have just recapitulated.

The experiments that we shall now speak of offer Mr. Pillet an almost unique opportunity of verifying the accuracy of his theory and formulas on a large scale. It concerns a huge kite constructed and experimented with last May by Mr. Maillot, and a description of which we find in the *Aeronaute*.



MAILLOT'S GIGANTIC KITE.

This kite is a regular octagon, having a superficial area of 85 square yards, and the frame of which weighs 150 pounds. The canvas and cords weigh 99 pounds, and the kite has lifted a bag of earth weighing 150 pounds. The structure of the affair and its unusual dimensions render the maneuvering of it peculiar. Two cords, maneuvered from the earth, and connected with the two extremities of the vertical line passing through the geometric center of the kite, permit of giving the latter the proper inclination, according to the velocity of the wind and its variations. Two assistants prevent a lateral inclination.

After firmly fastening the cord, which was 820 feet in length, Mr. Maillot and his assistants lifted the top of the kite and let the wind in beneath. The affair then arose, and lifted a 150 pound bag of earth to a height of 32 feet above ground. It is in such a position that it is shown in the accompanying figure. Each operator pulled in or paid out the cord according to the velocity of the wind, and the kite preserved a certain amount of stability.

In the discussion that followed the communication to the French Society of Aerial Navigation regarding these experiments, Mr. H. De Villeneuve recalled the fact that the English journals had once spoken of a woman being lifted by a kite in the last century.

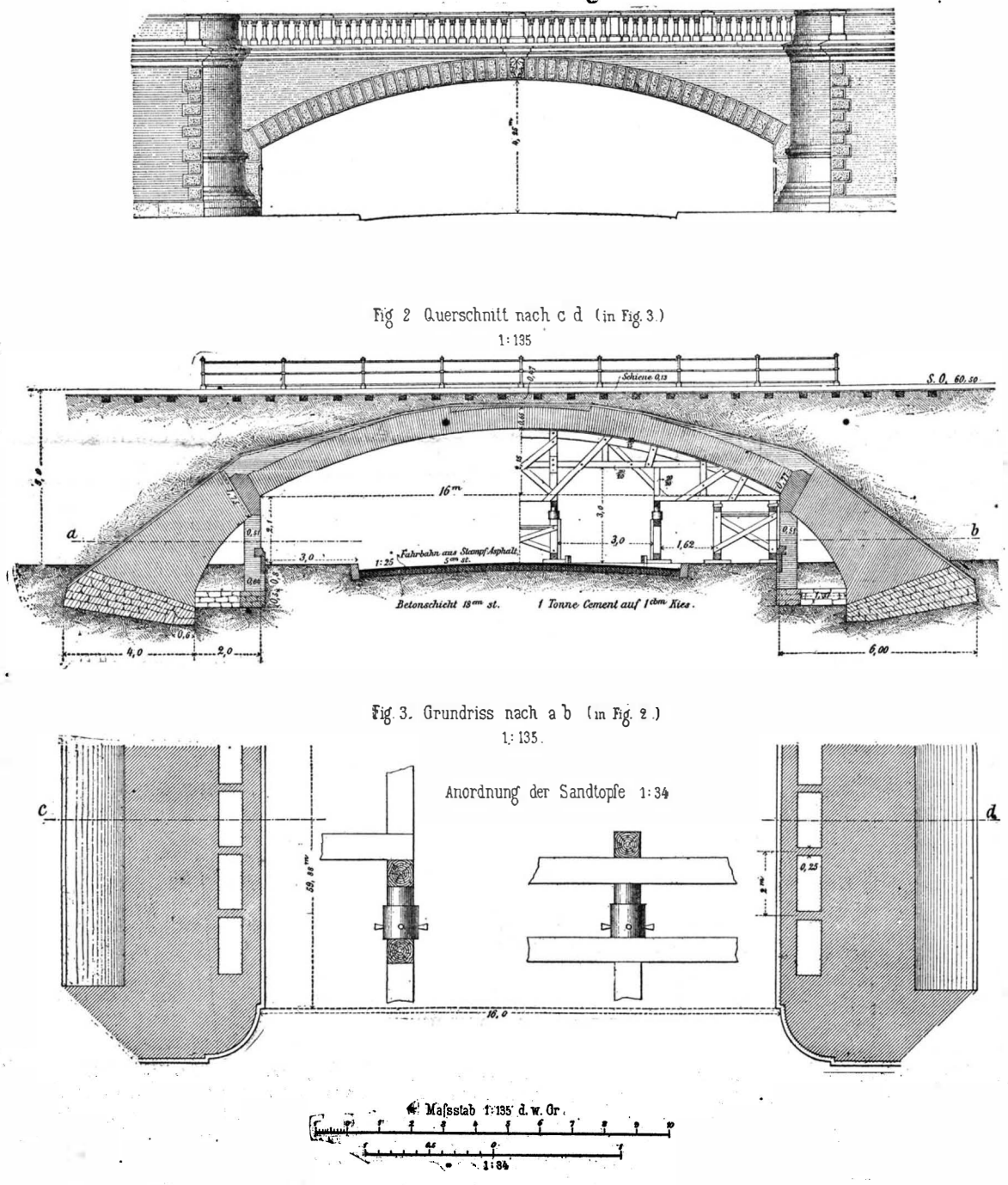
It was the constructor's idea that the maneuvering of the cords that regulate the inclination ought to be performed by the person lifted in the place of a bag of ballast; and the kite would then have been connected with the earth only through the main cord. This bold and dangerous experiment was opposed by the spectators on the 16th of May last, when Mr. Maillot operated his kite in the presence of the members of the Society. It was rightly feared that Mr. Maillot, after he had been lifted, might not manipulate the cords properly.—*La Nature.*

THE NEW TUNNEL, KONIGSTRASSE, BERLIN.

This tunnel is about 52 feet wide, 14 feet high, and 188 feet long, and is arched, as is shown in the accompanying cut. The masonry of the crown of the arch, that is to say, the central fourteen feet of the curve, is about 2 feet 1½ in. thick, and from these points to the impost its thickness is about 2 feet 5·3 in. The abutments and arch are faced with Greppin brick, and the frontal face and projecting edges with hewn stone.

The abutments are made of hard burned brick set in cement, and the voussoirs are arranged according to the line of pressure. To effect a saving of masonry, the abutments are not solid, but are built with openings; and to prevent the tipping of the abutments before the completion of the arch, 9 iron braces were placed 6 ft. 6 in. apart, and walls were built from the arch to the outermost limits of the street. These walls, as well as the wings, the faces, and the under surface of the arch, are faced with Greppin brick.

The arch was very carefully built of narrow voussoirs, so that when completed the crown sank 1·5 millimeters. The centering had to be arranged so as not to interfere with the traffic of Konigstrasse. So two passages, each 10 ft. wide, were left for the vehicles, and a passage about 5 ft. wide was left on each side for pedestrians. Tubs filled with sand were used for the support of the centering, and each of these tubs was provided with a plug, all of which plugs could be removed at the same time when the arch was finished, so that the tubs could be emptied, and in this manner an even and rapid settlement of the arch was accomplished.



THE NEW TUNNEL, KONIGSTRASSE, BERLIN.

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In calculating the strength of the arch, moving weights were considered.

The entire cost of the tunnel was about $5,964.00.—*Zeitschrift des Archit.*

Economy of Triple Expansion Engines.

The Coot is a vessel of 2,650 tons dead weight carrying capacity, is 270 feet long by 37 feet beam, and 18·5 draught above keel. Her triple engines have cylinders of 19½ inches, 32½ inches, and 53 inches diameter by 36 inches stroke, working on three cranks, and are all fitted with piston valves and dynamic valve gear. The Moorhen, a sister ship with which comparison of coal consumption and speed was made, is a vessel by the same builders, having a dead weight carrying capacity of 2,455 tons, is 260 feet long by 32½ feet beam and 19·3 draught above keel. She is fitted with ordinary compound engines by an eminent North Country builder, the cylinders being 33 inches and 62 inches in diameter, and 39 inches stroke.

On the completion of the voyage, Captain Croft, the marine superintendent of the Cork Steamship Company, reported that the Coot had steamed 8,258 miles on a consumption of 526 tons of coal, of which 320 tons were North Country coal of very inferior steaming quality, and 206 tons Welsh procured at Malta. The Moorhen steamed 7,555 miles on a consumption of 692 tons, the ship having still 703 miles to go to make up the distance covered by the Coot, and the 692 tons coal being made up of 552 tons of Welsh and 140 tons of West Hartley coal. Captain Croft further states that "there were exceptional circumstances telling against the Coot, head to wind for several hours going from Alexandria to Smyrna, through heavy rolling and the cargo getting adrift; and on homeward passage from Malta the Coot had strong head winds, while the Moorhen had fair wind and fine weather."

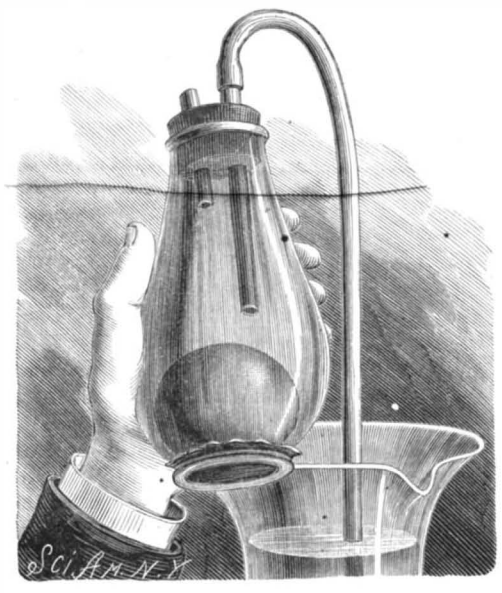
The average speed of the Coot in moderate weather is 9¼ knots per hour when fully laden.

Mr. F. C. Kelson, of Liverpool, the engineer-superintendent to the owners, reported: "As far as we can at present make out, the Coot burns 25 per cent less fuel than the Moorhen for the same length of steaming, which is of course very satisfactory, considering that the Coot's average speed is quite equal to the Moorhen's, and also that the Coot has greater carrying capacity than the Moorhen."

EXPERIMENTS IN EQUILIBRIUM OF FLUIDS.

T. O'CONOR SLOANE, PH.D.

In the last issue was described a simple construction of the well known cup of Tantalus. In the cuts are shown two additional illustrations of siphon action, in which the expansion of thin India rubber is used to indicate the effect. A lamp chimney having a projecting flange around its lower edge is used. A piece of the thinnest pure gum India rubber sheeting is placed across and covering the opening of this end. A rubber band is sprung over it, so as to confine it to its place. As this connection must be very secure, a strong band is essential. A ring such as is sold for use on umbrellas for confining the ends of the rods is very good. This

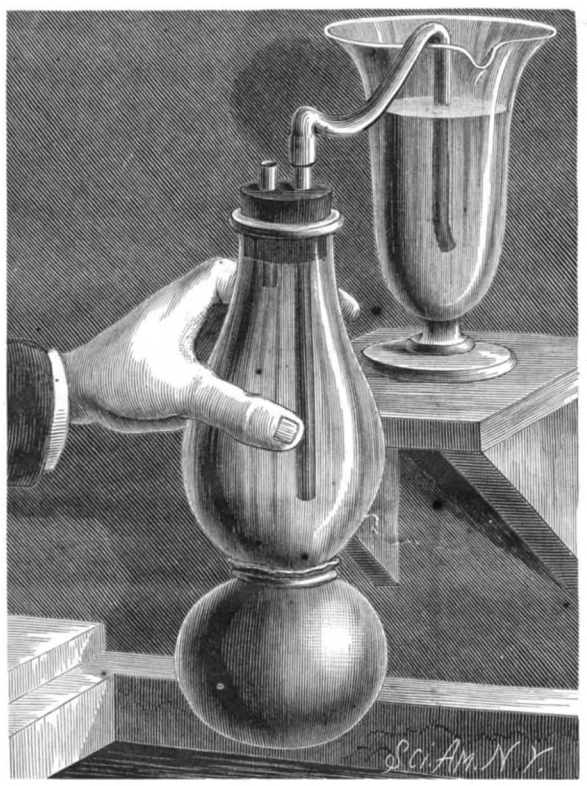


SUCTION OF A SIPHON.

will force the sheet against the glass and into all irregularities, so as to make a watertight joint. The rubber is not to be stretched in doing this, but is kept a little loose.

A tight cork of India rubber with one perforation, or if with two, one must be stopped, is provided that fits the upper end of the chimney. A tube of glass is inserted in the opening in the cork and is connected to a flexible tube of rubber. This forms the siphon. The chimney is filled with water. The rubber will bulge a little under the weight, but not very much. The cork is then inserted and the end of the flexible siphon tube is immersed in a vessel of water standing on the same level as that occupied by the chimney.

To illustrate suction, the chimney is lifted up until two feet or more of siphon tube depends from it. The rubber is now pressed in and upward. It expels air from the siphon and charges it, or fills it with water. Suction immediately begins to be felt, and the rubber curves inward. If the column is of a particular height with reference to the thickness of the rubber and diameter of the opening, nothing more than a slight inward bulging will thus be produced; but if the rubber is pressed further inward with the fingers, it will gradually yield to the pressure and rise up and in



PRESSURE OF A SIPHON.

more and more. After getting started it will slowly rise up without assistance, growing thinner until so transparent as to be almost invisible. The way in which the pushing upward seems to help it is to be noticed particularly. This increases the area on which atmospheric pressure can be exerted.

To illustrate the pressure at the lower end of a siphon, the position of things must be reversed. The chimney is lowered and the vessel of water is raised up. The rubber immediately straightens, and begins to curve outward, and gradually assumes an almost perfectly spherical shape. Thus it also affords an illustration of the equality of hydrostatic pressure in all directons.

In both these experiments, the chimney should be held over a basin or pitcher, as there is danger of breaking the thin rubber.

The last experiment shown is one illustrating the mechanics of a drop of water, and incidentally some other laws of equilibrium of liquid bodies. A hoop of wood or metal, from fourteen inches to two feet in diameter, is required. This may be made from a cheese box, or a hooped section may be sawed off from a well-made barrel. A piece of the same thin rubber is spread over it, and tied on securely. To make it act well, the tension on the rubber must be just right. If too much or too little, a poor result will follow. For a fourteen inch hoop a slight tension is enough. A string wound tightly around it for five or more turns, and then tied, will secure it. This is then supported over a tub or receptacle for water, in case it should break.

Water is then poured into it. As it is introduced, the rubber takes the form of a portion of a sphere, and descends more and more as water is added. At last a point is reached when it is in unstable equilibrium, and the addition of a little more water causes it to suddenly descend two or three inches, and change its shape materially. These two conditions are shown in the drawing, the first by a dotted line. Sir William Thomson uses this in illustration of the equilibrium of a drop of water, as showing that it has two forms of rest. If the amount of water added is just right, the rubber will remain in either of the two positions indifferently. If added as just described, the withdrawal of a small amount will effect the purpose. The original paper of Sir William Thomson, published under the head of Capillarity, in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 562 and 563, may be referred to here.

If the amount of water is a little less than is required to produce the lower position, and the hand is immersed in it, the same effect is produced as if water were added; as the hand is lowered, the rubber descends in the most curious manner, receding from the hand. If a coin is previously placed in the center, and an effort is made to extricate it, the effect is quite peculiar. A paradoxical aspect is given by the fact that apparently no weight is added. As everything immersed in water is buoyed up by a force equal to the weight of the water displaced, so the hand is pressed upward by this factor. But an upward pressure implies an opposite and downward one, and under this the water descends. Another way to treat the question is based on the fact that the pressure of water varies with the depth. By introducing the hand as described, the water is made to rise by the displacement. Hence a deeper column acts upon the rubber, and presses it down.

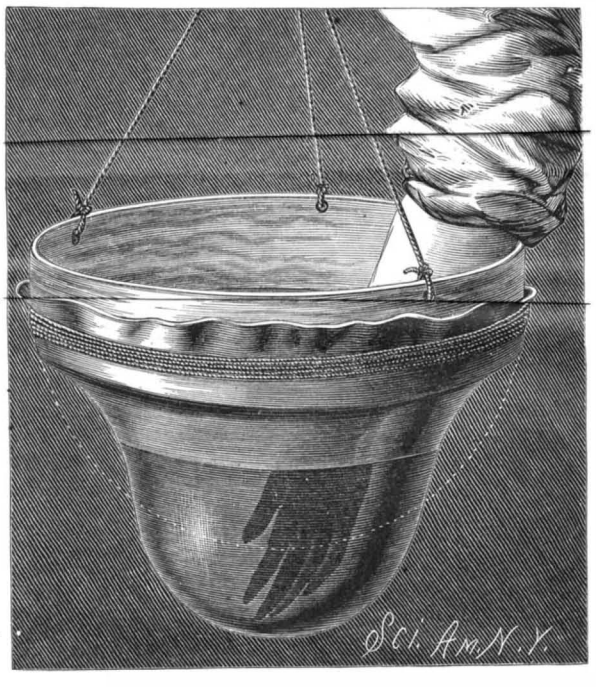
In constructing the apparatus, the thinnest rubber sheeting is the proper substance to use. Of course, no woven fabric, such as is used for waterproof cloaks, is available. If this and the question of tension are attended to, after one or two trials the apparatus will be successful. The tension will probably not work well on the first trial. The size of the hoop is important. It is not worth while to try it on a small scale. The sizes given really represent the minima from which a satisfactory result can be obtained.

Fireproofing Wood.

A mode of rendering wood incombustible not generally known is described as follows: Soak 27·5 parts by weight of sulphate of zinc, 11 of potash, 22 of alum, and 11 of manganic oxide in lukewarm water in an iron boiler, and gradually add 11 parts by weight of 60 per cent sulphuric acid. The wood to be prepared is placed upon an iron grating in an apparatus of suitable size, the separate pieces being placed at least an inch apart. The liquid is then poured into the apparatus and the wood allowed to remain completely covered for three hours, and is then air dried. The mode of application described is, we fear, a serious obstacle to the general use of this process for timber employed in building, especially as the rough timber, before being worked or framed, could only be conveniently treated in this manner. If joists, ceiling beams, and all joinery exposed to fire could be treated after being fixed with some chemical solution of proved resistance to the action of flame, we believe many architects would be found to employ it.

Longevity of Turtles.

In 1824 Mr. J. W. Warrington, one of the pioneer pedagogues of this vicinity, found a small *Testudo carolina* Linn., on the plastron of which he engraved, with his penknife, "J. W., 1824," and set it free near Albion, Ill. Some time during 1865 Mr. W. Hodson found it in the same vicinity where it had been set free forty-one years before. He engraved the letter "W" on the carapace and again set it free. Nothing more was seen of it until August, 1885, when it was found by Mr. Herbert Hodson (brother to W.), about one-half a mile from the spot where it had been set free twenty years before. He put it into his cellar, where it remained until this (1886) summer, when it by accident was poisoned by "Rough on Rats," and died from the effect. The engravings are all apparently as clear as when first made. The tortoise was below the medium size, and appears to have grown very little since the first engraving was done, sixty-two years



WATER DROP.

ago. The shell is darker and smoother than usual. On the back is a scar, which appears to be the remains of an extensive fracture. Mr. H. Hodson has three other tortoises that were engraved twenty-one, seventeen, and sixteen years since respectively. In illustration of the slow growth of these reptiles, I will mention that more than a year since, he broke open an egg in which was found a young tortoise. This he has since kept in confinement. It has made no perceptible progress in size during this time. Several years since, I kept a young *Pseudemys elegans* Wied. in confinement for more than two years. It made no perceptible increase in size, yet it partook quite freely of food.—*J. Schneck, Mt. Carmel, Ill., American Naturalist.*

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Bessemer Converters in the United States.

At a recent meeting of the Iron and Steel Institute, London, Mr. James P. Witherow, of Pittsburg, whose converter had been described by Mr. Hardisty, said that in America, within the past two years, considerable headway had been made in the development of the Bessemer process with the fixed or stationary type of converter. Up to the present, however, sufficient reliable data have not been obtained to enable the claims that might be advanced to be fully determined and demonstrated. The reason for this fact is twofold. First, because the year 1884 was consumed in experimenting with and remodeling the Clapp-Griffiths type of converter by Messrs. Oliver Brothers, of Pittsburg, to the type the speaker now recommends, and which he now has in successful operation; and, secondly, because in such experimental stages it is more difficult to obtain reliable data, and even when obtained it is often more difficult still to get those interested to credit the facts put before them. However, the results of the working of Mr. Oliver's new converter, which was substituted for that of the Clapp-Griffiths, were such that during the winter and spring of 1884–85 contracts were closed for seven distinct plants, about one-half of which were in use during the past summer, and all will be working in the coming winter. From this fact, the speaker thought, it would be seen that a fairly extended field was at command from which he could gather reliable information, the area of observation extending indeed from the Mississippi to the Schuylkill. Oliver's plant, the speaker continued, apart from being the pioneer in America, was constructed from very crude designs, sent over from England, from which the makers were forbidden to deviate or in any way change. This was unfortunate, as it led to failures in working at the commencement, and although the difficulties had been overcome and excellent work had been done by Mr. Oliver's plant during the past year, they found the first unfavorable impression very difficult to eradicate. Bessemer practice in the United States owed much to Mr. Oliver's experiments, for before that time, Mr. Witherow stated, they had no idea of being able to make boiler plate or flanging steel, and it was only after his investigations had been published that workers by the Bessemer process began to experiment on low silicon, and this was accomplished by blowing small or half charges in the converters. By dint of great care and attention, following Messrs. Oliver's practice, the Bessemer workers have been able to approach it in the matter of quality, but seem indisposed to carry it out to a successful commercial issue. The Bessemer works of the United States that have been built for the rail trade are of little use, the speaker thought, and of no benefit to the general iron and steel trade of that country. It was true that in times of depression they forced themselves into the market and sold blooms, billets, and plates. But consumers had to accept whatever qualities of steel the makers happened to be producing, no matter how irregular in quality it might be, or unsuitable for the purpose required. Consumers were never allowed to complain, as the steel makers considered their practice infallible. But the moment they fill up with rail orders the general consumer is completely ignored, and therefore it behooves the trade to seek other means of supply. It is for this reason that the small fixed converter seems destined to play an important part, and the speaker thought that, in the United States, such a description of plant will take the place of the more general type for supplying the smaller class of work.

Mr. Witherow had only been able to obtain practical data from two plants up to last August. These were that of Messrs. Oliver, and another of the Western Nail Company, of Belleville, Illinois. The first is one of Mr. Witherow's latest designed converters, but it is smaller than those more recently erected. It would blow from 3,500 lb. to 4,000 lb. of iron at a charge, while the latter will blow from 6,000 lb. to 6,500 lb. The Western Nail Company's plant is of the latter size, but there is one now in construction which will take over 8,000 lb.

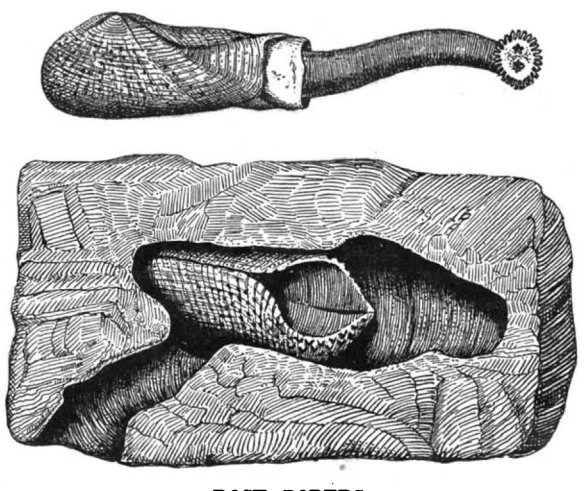
At Messrs. Oliver's, with two small converters working alternately, *i. e.*, following each other instantly on blast and charging, there has often been made 125 tons in a day of 24 hours, and over 75 tons has been made in a single turn. When working up to this output Mr. Oliver states that he can make his ingots at a cost of five dollars per ton, including waste, labor, ferro-manganese, and refractories, everything, in fact, but pig iron. The allowance for waste is two dollars, and it averages from 12½ per cent to 14 per cent. All the cinder in slag from the converter and all collections of shot about the platform are remelted in the cupola, and by this plan the waste is said to be reduced by at least two per cent.

Experiments have been made at Oliver Brothers' works with phosphorus pig, ranging in mixture up to from 0·34 per cent to 0·44 per cent. of phosphorus, and from this excellent cut nails were made. At the Western Nail Company's works, last July, similar experiments were made under the direct inspection of Dr. T. M. Drown, professor of chemistry of Boston, Massachusetts, and his observations were embodied in a paper he had prepared on the "Little Bessemer Process," and read before the American Society of Arts. In conclusion, Mr. Witherow said that no doubt his unpretending type of the Bessemer process has to contend against great odds, and as it is in the beginning of its development, it is impossible to obtain complete data to support the claim made by the few friends it possessed. If, however, positive proof of his claims could not be submitted in a year's time, then metallurgists and steel makers would have sufficient grounds for treating his statements with indifference.

ROCK BORERS.

According to the usual course of things, we would hardly look into the class of mollusks—the very name of which is derived from *mollis*, soft—to find an animal fitted for drilling holes in solid rock. Yet, nevertheless, it is here we find the rock borers. They are bivalves, the shells being thin, but brittle and hard, more or less open at both ends, and armed anteriorly with rasp-like spines. The animal itself is either club-shaped or worm-like; the mantle is closed in front with the exception of an orifice through which the truncated foot is passed; and the siphon tubes are long and united nearly or quite to the ends. The species are rather numerous, and inhabit most parts of the world.

The question as to how these mollusks bore out their dwelling places in the rocks has been a subject of much discussion. The supposition that the shell is the instrument of perforation originated with Bonanni, in 1684, and in the present century most naturalists have favorably entertained it. M. Cailliaud is a great upholder of this theory, and thinks he has clearly proved



ROCK BORERS.

by numerous experiments that such is the case. Geffreys says it is easy to scrape with the edge of a limpet-shell a cavity in chalk or shale, such as the rock limpet occupies; but can it be imagined that in this case the shell instead of the foot is naturally employed for that purpose? The fine and regular striæ or grooves, which are plainly marked on the sides of the cell or hole of the rock borer, are unquestionably caused by the friction of the spinous ridges that ornament the shell. These grooves are wanting at the bottom of the cell, and are replaced there by a far more delicate elaboration, which is, without doubt, produced by the sucker-like motion of the foot. Prof. Owen attributes part of the process to the action of the foot, which is sucker-like, and enables the animal to fix itself to the substance which it intends to perforate. The softness of the foot offers no obstacle, for it is certain that the perpetual renewal of a softer substance will render it capable of wearing away a harder one, subject to the friction of a softer surface, and, not like it, susceptible of being repaired. Lewis says the soft muscular disk is perpetually renewed, and the hard limestone has no self-renovating power; and thus, just as falling water wears away granite by the incessant repetition of gentle blows, so do these mollusks excavate rocks or wood by the incessant repetition of muscular friction.

Some writers have affirmed that the foot is armed or studded with silicious particles, thus forming a perfect boring instrument, on the principle of a "diamond drill." Others, again, declare that no such instrument exists in any of the species.

It has been generally supposed that the rock borer does not secrete an acid. However, both Thorrent and Cailliaud have discovered that they, at least some species, do secrete an acid, which may assist them in perforating the rocks they inhabit.

The work of boring into such rocks as gneiss must be extremely slow. It takes about a year and a half for a *pholas* to arrive at maturity; by that time it has made a hole five or six inches deep.

The property the rock borers possess of giving forth phosphorescent light in the dark is remarkable. This property is not confined to the skin or outer membrane, but every part of the body, and when a pholas is cut into pieces each portion is luminous, and much of the water that drops from them sparkles brilliantly. Out of fifteen living specimens obtained by Cailliaud, at the end of April and in December, ten or twelve only gave out phosphoric light. In none of these did the foot exhibit any luminosity. Geffreys says: "I am disposed to believe that this light is caused, *not* by the rock borer itself, but by extraneous microscopic organisms; but," he adds, "the subject ought to be further investigated."

The rock borers have been found inhabiting new red sandstone, slate rocks, coal shale, hard rocks, chalk, marl, and submarine wood.

A curious little boring mollusk, the *Martesia cuneiformis*, is sometimes found in the oyster shell along our coast. In a large shell from the Chesapeake Bay, Md., I counted six excavations made by this little borer. None of the holes, however, went entirely through the shell. There was no mistake as to what animal drilled the cavities, for each of them contained a *Martesia*.

C. FEW SEISS.

The Dreams of the Blind.

A paper read before the biological section of the American Association for the Advancement of Science was on "The Dreams of the Blind," by Dr. Joseph Jastrow. The object of the paper was to determine the extreme age at which a child may become blind and yet lose all memory of the visible world, so that it no longer sees in its dreams.

Almost all dreams of normal persons are sight dreams, and a dream is often spoken of as a vision. The blind are deprived of this most important sense; but if they have not been born blind, they may remember enough of what they have seen to enable them to imagine how things look, and when the imagination has free play in sleep, to picture themselves as in full possession of all their senses. Physiologists would explain this by saying that during the years in which they saw, a certain part of the brain has become educated to receive and interpret all these messages which the eye sends, and that when this part of the brain acts spontaneously in sleep, the person dreams of seeing. Such a portion of the brain would be called the sight center.

If now we find out the latest age at which blindness may set in and yet the person keep on dreaming of seeing, we shall find out the time it takes for this sight center to develop. For this purpose about 200 blind persons of both sexes were questioned at the institutions for the blind in Philadelphia and Baltimore, and it was found that those who became blind before their fifth year never dreamed of seeing; of those whose sight was lost between the fifth and the seventh year, some did and some did not see in their dreams; while all whose eyesight was destroyed after the seventh year had quite as vivid dream visions as seeing people. The fifth to the seventh year is thus shown to be the critical period. This period corresponds with the age which authorities assign as the limit at which a child becoming deaf will also become dumb, and also with the age of one's earliest continuous memory of one's self.

It is interesting to note that blind persons dream quite as frequently as normal people, and that with those who do not see in their dreams, hearing plays the principal part. When dreaming of home, for instance, they will hear their father's voice or their sister singing, and perhaps will feel the familiar objects in the room, and thus know they are at home. We, in such a case, would see it all.

Cold and Tobacco Smoking.

Dr. Chudnovski publishes in the *Russkaya Meditsina* an account of a series of observations made on twelve soldiers in a military hospital, who were perfectly healthy with the exception of slight injuries, with the object of determining the effect of cold applications to the epigastrium upon the rapidity of digestion. The stomach tube was of course freely used, and the completion of digestion was taken to be marked by the disappearance of solid particles in the gastric contents, as revealed by drawing them up through the tube. The author found that when ice bladders were applied next the skin over the region of the stomach, digestion was retarded in nine out of the twelve cases. Six of the men were smokers and six non-smokers. In the former the time required for digestion averaged seven hours, while in the case of the non-smokers the mean period of digestion was only six hours.

An Interesting Monument.

M. Clermont-Ganneau has communicated to the Academy of Inscriptions and Belles Lettres a note relative to a discovery made by him in an old building at Jerusalem. It was a block of stone, with a Greek inscription signifying that any stranger who should have passed that limit would be condemned to death. It is evidently a fragment of one of the posts which formed, in the temple built by Herod, a dividing line between the exterior inclosure of the Gentiles and the inner precinct reserved for the Jews. It will be remembered that St. Paul barely escaped stoning when he was accused of having introduced Greeks into the inner circle with himself. The stone has been removed to Constantinople, but a cast has been taken, which will be preserved in the Museum of the Louvre.—*Cosmos.*

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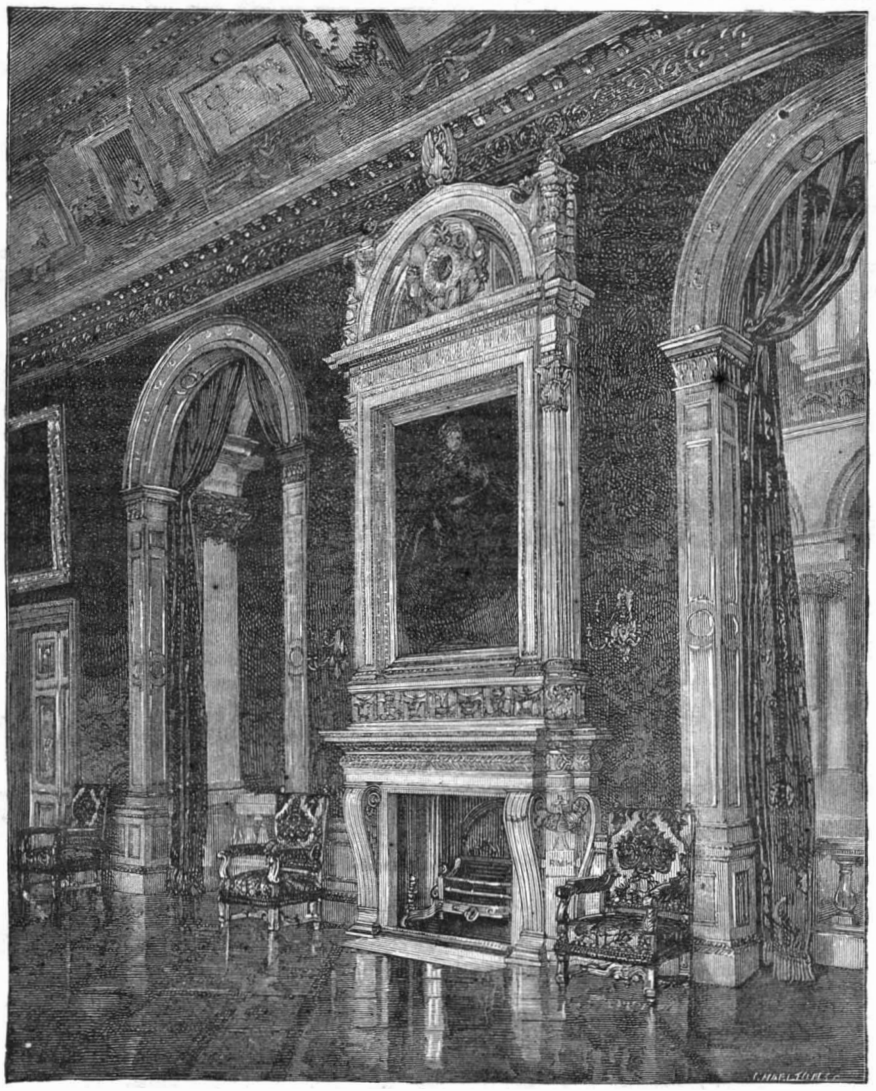
A SUMPTUOUS MANTEL.

To design a mantel for a room of such height as the one shown in the accompanying illustration, so that it shall not be dwarfed and petty in appearance in comparison with the other features of so noble an apartment, and yet not be given an obviously undue importance, is a work which calls for very careful judgment, as well as an educated taste. The manner in which the artist has in this case dealt with the difficulty is not only extremely satisfactory for just such a room as that here shown, but it will be at once suggestive of many ways in which a similar method of treatment can be adopted for smaller and less richly decorated apartments. In place of the elaborate carving and large proportions of what here forms the framework of a picture, the mantel with its open fireplace constituting the base, and all according with the sumptuous character of its surroundings, a smaller and more simple style of room would call for mouldings corresponding with those of the framework of the doors and windows, and with a degree of ornamentation proportioned to that expended upon other features of the apartment.



MANTEL ADAPTED TO A NOBLE APARTMENT.

NATURAL HISTORY NOTES.

A young female hippopotamus was placed on exhibition at the Central Park Menagerie last week. From Saturday, October 16, when it reached this port on the steamer Eider, until the following Wednesday it remained boxed up without room enough to turn round. Placed in the lion house, near where its tank was being built, it watched the men at work and marked the progress of construction with evident interest; for having once before lived in a tank—at the Handels menagerie of Carl Hagenbeck, the animal dealer of Hamburg—it seemed to understand what was going on.

Theee times a day it is fed, and without taking the trouble to rise to its feet, opens its mouth like a young bird and receives its food. Three or four quarts of oats or cut feed, washed down with a few gallons of clear water, constitute a meal with the hippopotamus, and when it is over a nap follows, and then the eyes of the great beast are fixed once more on the workmen putting the finishing touches on its tank. The specimen weighs about 1,500 pounds, is dark on the back and pinkish-white about the shoulders, and may be considered at the present time rare, because the recent troubles in North Africa, where these animals abound, has rendered it impossible to get hippopotami.

This one was captured in the Nile waters when but a mere infant, some three years ago. It was so small then that it was carried some distance in a man's arms, and was brought to Cairo on a camel's back. When lying down out of the water with its chubby legs curled under it and the huge folds of flesh hanging in festoons on either side of its back, it looks not unlike a prize hog. It is said to be unusually good natured for a hippopotamus, wagging its six inch bristling tail when approached, and, though of a most forbidding aspect, is harmless.

Naturalists are not yet agreed just how long a hippopotamus can remain under water. Usually the time is from half a minute, as is the case with that seen at the Park, up to 2½ minutes. But instances are recorded where they remained under water much longer than this. Here is a remarkable case: In 1872, the hippopotamus in the London Zoological Gardens gave birth to a very robust specimen, which a few hours later was able to walk and swim. The mother, before docile and good natured, became fierce and intractable. She growled and showed her teeth whenever her keeper approached, and at times evinced the same hostility to her offspring.

The second morning after its birth the infant could not be found. At first it was thought to be in the tank, and the keepers waited in vain for it to appear. After some 15 minutes' waiting, it was determined to let out the water, in hopes of finding the body. The old one growled savagely when she discovered the water lowering, and after lashing the water furiously, finally climbed up on to the bank, and a moment later the young one appeared on the surface as lively as ever. It had been under water all this time.

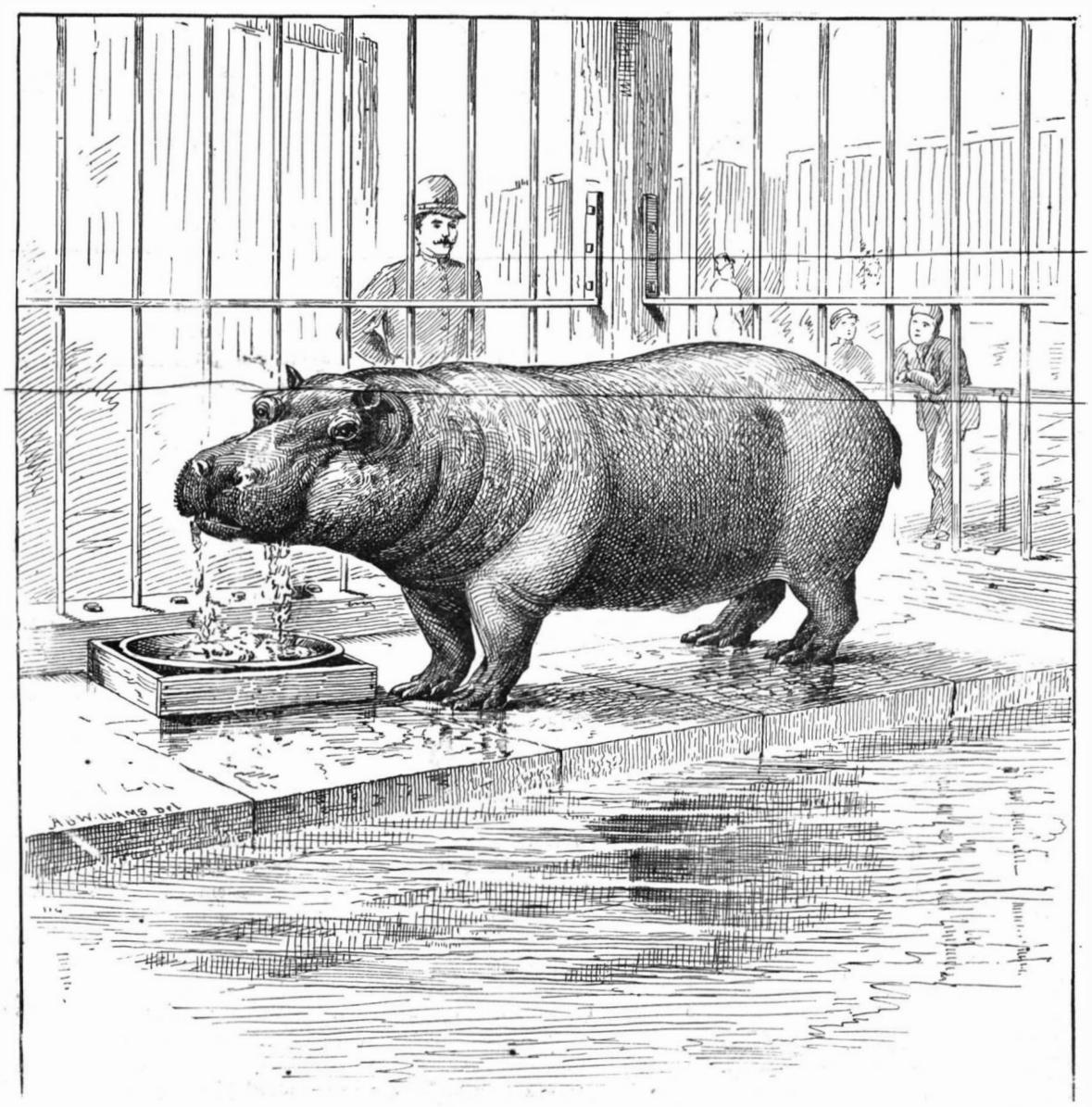
Two black panthers from India (*Felis pardis*, Linn.), one full grown and measuring 6 feet from tip to tip, and a pair of striped hyenas (*Hyaena striata*) came over on the same ship with the hippopotamus, and are now on public exhibition. The black panther is to its class what the albino is to the human species, or the black sheep to the remainder of the flock. It appears occasionally in the litter of the yellow or tawny colored panther, and has the same habits and characteristics as its ordinary prototype. The American puma, which is a panther, gives birth at times to the black variety.

Some authorities maintain that the black panther is a distinct species, which they call *Felis melas;* but there would seem to be little, if any, evidence to sustain them in this. Others, seemingly with some reason, object to classing the panther with the leopard (*Felis jubata*), which it is customary to do. When the prophet Habakkuk spoke of the Chaldeans as "That bitter and hasty nation. . . . Their horses also are swifter than the leopards," he could scarcely have referred to the pard or panther, for he is slow, whereas the leopard is capable of maintaining a very rapid pace.

An authority says that if the appearance of black panthers is only accidental, it is rather curious that they do not occur among the larger of the cat tribe, for that a black tiger would be a great prize, no such specimen having ever been known.

The panther, unlike the tiger, may be said to be untamable and treacherous. By nature he is vicious, and though he be reared from a cub in captivity, is not to be trusted. He may be docile for months, and then fall upon his keeper and tear him to pieces. He will even at times suddenly attack his cage mate of the same species, kill him, and eat his fill of the victim.

The newly arrived hyenas are from South Africa, and a rare variety; the common being spotted instead of striped. They have bristling manes, which rise when they are vexed, and their coats are much finer than those of the spotted.



THE NEW HIPPOPOTAMUS AT CENTRAL PARK, NEW YORK.

Feed Water Pipes Should Have Valves.

Power says: Care should be taken in making boiler connections to have some means of cutting off the steam or water in case of breakage. Connections that are not thus protected are always a source of danger, and among the worst is the water grate. If one of these burst there is no means of shutting off the water, and the boiler will soon be blown empty. But there are other places where a neglect to provide a valve is the result of pure carelessness. It is not uncommon to find the feed pipe connected without a valve between the check and the boiler. Then, if any accident happens to the latter, there is no way of getting at it while steam is on.

THE oleomargarine law went into effect Nov. 1. All of it and of butterine now sold must pay a tax of two cents a pound, and be plainly designated to distinguish it from butter.

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ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. John P. Ketteringham, of Natchez, Miss. It has pivotal parallel coupling bars, with enlarged circular pivoted ends, and the link is made with a square body having central projections, with arrow headed ends, while there are other novel features, the whole designed to make a simple, strong, and effective coupler, which can be operated conveniently from the top, end, or side of a car.

A revolution or stroke counter has been patented by Mr. William Voit, of Magdeburg, Prussia, Germany. It is operated by the changes of pressure in the cylinder of the driving engine, the lever connections heretofore in use being dispensed with, and the connections between the counter and the cylinder being made by small pipes or tubes, and the whole apparatus being one that can be placed in a small box entirely closed, so that its operation cannot be interfered with by a stranger.

A metallic railroad tie forms the subject of two patents issued to Mr. Ellery C. Davis, of Crookston, Minn. The tie consists of two parallel bars with a channel between them, blocks fitting into the channel and having hook projections to fit upon the base flanges of the rails, bolts securing the blocks to the bars, so that the rails can be readily secured to the ties and will be held securely in place; provision is further made for recessed spacing blocks, and spikes and wedges adapted to the recesses, whereby the rails can be readily leveled when thrown out of level by the frost.

MECHANICAL INVENTION.

A take up and let off mechanism for looms has been patented by Mr. Matthew C. Williams, of Adams, Mass. The construction is such that with every beat of the lay the let off roller is revolved with a positive movement a fixed distance, to let off a given length of warp, and at the opposite end of the loom, by corresponding mechanism, the take up roller, with a positive movement, revolves the cloth roller to take up the slack of the cloth continuously.

AGRICULTURAL INVENTION.

A cotton chopper has been patented by Mr. John R. Rector, of Salado, Tex. It is a chopping hoe so made as to be readily applied to any ordinary cultivator, and not be liable to catch upon stumps or other obstructions, and not likely to bruise or otherwise injure the plants left for a stand.

MISCELLANEOUS INVENTIONS.

An ice creeper has been patented by Mr. Michael S. Weller, of Charlestown, W. Va. It has a pin supporting plate, adapted to be movably supported in the heel, whereby its pins may be projected out of or incased within the heel, with various novel features of construction and combination of parts.

A machine for making wire bale ties has been patented by Mr. William A. Laidlaw, of Cherokee, Kansas. This invention covers a compact and simply constructed machine, which is easily operated, and by which wire bale ties can be made with less labor and more rapidly than heretofore.

A car starter has been patented by Mr. Robert T. P. Allen, of Farmdale, Ky. It is a novel construction, providing mechanism for storing up the force represented by the momentum of the car when it is stopped, in such a way that, on starting, this force is exercised with a great leverage to start the car.

A coat has been patented by Mr. John G. Weimer, of New York city. It is closed in front and open at the rear, and has hand protectors and pockets covered by a shield, and is intended especially for the use of street car drivers and others who are exposed mainly from the front.

An annunciator has been patented by Mr. Charles H. Dowden, of Newark, N. J. It is so constructed that the signals disappear automatically after they have been exposed to view, and require no special manipulation by the operator to remove them, while the adjustment may be such that the signals will remain visible until they are shifted at the instrument.

A breeding calendar has been patented by Mr. John W. Snider, of Fairland, Ind. It has certain novel constructions and combinations of parts, whereby the calendar may not only be used as a changeable or perpetual one for ordinary purposes, but as a special one for breeding uses, and also in the hatching of the eggs of poultry or birds of different kinds.

A pants hanger has been patented by Mr. Andrew Flieger, of Portland, Oregon. It consists of a yoke provided with a central hook, and with two pairs of auxiliary hooks, whereby a number of pairs of pants may be hung upon a peg or hook not more than six inches in length, and no matter how long they are so suspended, they will not wrinkle or break.

A wrench has been patented by Mr. James G. Leslie, of Oregon, Ill. It has a fixed and a movable jaw, a locking lever, and various other novel features, being a simple and inexpensive construction, but adapted to gripe and turn square or round objects of various sizes, such as nuts and pipes, or shafts, and adapted also for use as a vise.

A separable button has been patented by Mr. Albert H. Graves, of Central City, Neb. It has a front plate with apertured or slotted rim, a slotted bottom plate, spring pressed bolts with thumb pieces, with other novel features, making a button which may be readily taken apart, and which, when put together, will be prevented from accidental separation.

An incubator has been patented by Mr. Clarence L. Wells, of Quincy, Ill. It has a lower heating section, an intermediate brooder section, and an upper tray section, there being a novel construction of air drum with upwardly extended flue and tubes, with appliances for regulating the heat and keeping the temperature as desired.

A mirror frame has been patented by Messrs. George Jones and Herman W. Trognitz, of Williamsport, Pa. It has a curved bar pivotally connected to the top and extending through a spring clutch adapted to hold it at any desired inclination, also a loose pivotal support at the bottom which will permit the mirror to be inclined and turned upon its axis.

A puzzle has been patented by Mr. Alexander W. Butterworth, of Poughkeepsie, N. Y. It consists of a square block, marked off into small squares, six each way, a hole or socket in the center of each small square to receive a peg, the puzzle being to so place six pegs that no two will be in the same or any line of squares or sockets.

A fifth wheel has been patented by Mr. Henry Hafker, of New York city. Combined with the upper and lower ring plates, with grooves in their adjacent faces, and opposite toothed ribs or racks, are two disks running in the grooves and connected by toothed shanks which engage the racks, being intended to give effective support to the body of the vehicle and allow it to be turned to either side with little friction.

A telegraph key has been patented by Mr. John M. Biggs, of Louisville, Ky. It has short and long arms, the former having a finger piece and the latter a contact point, combined with a switch and conductor for conveying the current from the switch to the stationary contact point of the key, the object being that a slight movement of the fingers shall produce a greater movement in the contact point of the key.

A device for closing openings in the hulls of vessels has been patented by Mr. John Speirs, of Jersey City, N. J. It consists of a special arrangement for clamping a plate or covering over the opening, having such form of brace bar and hook and angle bars that any suitable plate may be clamped over an aperture and the bar can be applied with dispatch and easily reversed when necessary.

A centerboard for vessels has been patented by Mr. David McFall, of New York city. This invention covers a novel construction and combination of parts in a centerboard rig, which allows the centerboard to be quickly set and removed, as sailing conditions and emergencies may require, and also allows the operation of the centerboard by a helmsman at the stern of the vessel.

A convertible street car has been patented by Messrs. Philip J. Smith, of Long Island City, and John F. McEvoy, of Brooklyn, N. Y. By a special construction, arrangement, and combination of parts, the sides may be raised to a position at the top of the car and lowered therefrom to close the sides of the body of the car, so that it can be easily converted into an open or closed car, as the season and weather require.

A combined note book holder and line indicator has been patented by Mr. Albert H. Merrill, of Sanford, Fla. It is for use by type writers and others, and consists in a board supported upon a standard or by attachment to the type writing machine, provided with a clamping device, combined with a line indicator and pawl and ratchet mechanism, for moving the line indicator down the page of the note book.

A gauge attachment for printing presses has been patented by Mr. Frederick F. Byington, of Oakland, Cal. It is for attachment to the platens of job printing presses, to fix the position of the cards or blank sheets, to cause them to properly register in receiving the impression from the type, and consists of curved spring bars, made tapering, combined with a special form of holder.

A lubricating compound has been patented by Mr. David L. McKenzie, of Winnipeg, Manitoba, Canada. It consists of animal fat, mineral oil refuse, slaked lime, and manganese, compounded and prepared in a specified way, to make a lubricator for car axle boxes and all sliding bearings, preserving for a long time its properties without decomposition or deterioration.

A door sill has been patented by Mr. Ezra H. Foster, of Fairmount, Minn. It is preferably formed of metal, its under surface being cored out by ribs to reduce weight, and it has a square shoulder to keep out water, with other novel features, being designed, in connection with a weather strip, to afford complete protection, while being durable and presenting a neat appearance.

A game has been patented by Claes E. Tranchell, of Willmar, Minn. A circular flat disk has a handle at one side, and a recess in which a marble will rest, the disk having holes or apertures in a circle on its face, and one in the center, the game then being to hold the disk so steadily and truly that the marble may be made to roll by all the holes and around the one in the center back to the place of starting.

A windmill has been patented by Mr. Samuel S. Simpson, of Clay Center, Kan. It has floats that are rigidly connected to arms that are pivotally connected to supports carried by a hub fixed upon the crank shaft, the parts being so arranged that the arms carrying the floats may be expanded to throw the floats into the wind, or backward to cause them to present their edges to the wind.

A furniture pad has been patented by Mr. William H. Hertz, of Hazelton, Pa. It has a soft rubber top or outer portion, and a hard rubber base apertured to receive a fastening, and a driver for driving the screw or fastening into the article to which the pad is to be attached, the object being to make a pad to attach to the backs of chairs, sofas, etc., to prevent injury to walls.

A shutter worker has been patented by Mr. Thomas N. Lupton, of Winchester, Va. It consists of a curved parallel motioned bar, combined with and jointed to a swinging link, a crank arm of the same length as the link, and a handle for working the bar, with other novel features, to facilitate working the shutters of a window from the inside without hoisting the sash.

A skylight cover has been patented by Mr. James W. Shaw, of Baltimore, Md. Combined with the skylight are rails at the opposite sides and a cover inclosing the sides, ends, and top of the skylight framing, with rollers embracing the rails, the object being to provide a construction which shall protect the skylight from damage in case of fire, and from storms, etc., while being simple and inexpensive.

A valve has been patented by Mr. Owen L. Whiteman, of Haydenville, Mass. This invention relates to certain improvements in "straightway" or "gate" valves, and consists in the manner in which the gates are suspended on the carrier, whereby a rotating or rocking adjustment is obtained, each gate having a motion opposite to the other, in the same direction, the one a horizontal and the other a perpendicular rocking motion.

A gate has been patented by Mr. Geo. W. Walters, of Deer Lodge, Montana Ter. This invention relates to gates of that class which are lifted and slid across the roadway, and are operated by hinged lifting bars, which in turn are operated by pulling on cords attached to overhead levers to which the gate lifting bars are connected, and provides therefor a simple and substantial construction, in a gate that can be operated by a person in a vehicle or on horseback.

An axle and box for wheels has been patented by Mr. Louis Steinberger, of New York city. The inner surface of the box consists of two straight bearing surfaces of different diameters, and the bearing surfaces of the axle are made to correspond to the axle box, being smaller at the outer and larger at the inner end, by which a space is allowed for lubricating material, and the axle is strengthened at the inner end where it receives the most strain.

An electric temperature alarm and thermostat has been patented by Mr. William H. Stiegelmaier, of Geneva, N. Y. Combined with the mercury tube and case of a balance thermometer, an electric contact is carried by the tube, and adjustable contact points arranged in the back of the thermometer case, in position to be touched by the contact carried by the tube, to make and break the electric circuit by the rise and fall of temperature.

A combined lock and latch has been patented by Messrs. Simeon J. and John W. Hicks, of Chicago, Ill. The operating mechanism is inclosed partly within a cylindrical case and partly within the knobs arranged in connection with the latch, there being certain novel features involved, the outer knob being disconnected from the latch in a peculiar and novel manner, and the lock being arranged to be operated from either side of the door.

A bobbin winder for sewing machines has been patented by Mr. Henry Lefeber, of Philadelphia, Pa. It is designed for winding the bobbins of sewing machines while at work, without further attention from the operator than placing the bobbins in the winder and pushing a frame toward the drive wheel, the winding being stopped automatically when the bobbins are filled, and the winder being one which may be employed with bobbins for silk weaving or knitting, or winding coils of magnets, etc.

A photo-chronograph has been patented by Mr. John J. Higgins, of New York city. It has a graduated dial, in front of which revolves an arm carrying a light-reflecting surface, combined with a motor and slow calibrating wheel whose period of rotation bears a fixed relation to that of the arm, an audible signal being operated by the wheel, the device being to determine the period of exposure of any drop shutter, or make a permanent record from which the duration of the exposure may be determined.

A wire fencing picket has been patented by Mr. Joshua Horrocks, of Brooklyn, N. Y. The invention covers a novel construction of twisted wire pickets suitable for forming border railings for lawn and garden walks, but also available for other uses, the pickets being made in U-shape, and having eyes in the side parts of their bends, the eye of each picket being made of sufficient size to receive an arm of the adjacent picket, and being formed by spreading the strands of the wires at the desired point.

A self-locking wire picket forms the subject of an additional patent granted to the foregoing inventor, which covers an improvement on the above construction in that where the eye is made to receive a leg of the adjacent picket, by spreading the strands of the wires, a pin or other form may be inserted between the strands when they are being twisted together.

A fencing machine has been patented by Mr. George L. Sutton, of Platteville, Iowa. It is to make wire and slat or paling fences, and is so constructed that a crank shaft may be placed in position, and wires hooked into clutches thereon, when, by turning the shaft, the pairs of wires are spread to permit of the palings being woven into the proper position, the apparatus being simple and strong in construction, and such as can be operated by one man.

NEW BOOKS AND PUBLICATIONS.

ESOTERIC CHRISTIANITY AND MENTAL THERAPEUTICS. By W. F. Evans. H. H. Carter & Karrick, publishers, 3 Beacon Street, Boston, Mass.

As the author puts it, this work is intended to open to the student the realms of Christian theosophy. Mr. Evans believes that disease is due rather to a mental than a physical condition; in fact he says that "there is nothing in the body that has not had a prior existence in the mind or soul." He takes advantage of what we all believe in to a greater or less extent—the mysterious influence of mind on body—and tries to develop this into a system by means of which all our bodily conditions can be altered to correspond with some acquired state of the mind. So illness is simply a state in which we believe our bodies to be in an abnormal condition, and by a due exercise of will the mind may be brought into a state of healthfulness, which the body will soon fall in correspondence with. We believe we are well, and with a magic touch we are cured. The author makes frequent appeals in support of his theory to Scripture, Buddha, Plato, Swedenborg, and others.

Special.

A SOLDIER'S STATEMENT.

FLEMINGTON, N. J., Oct. 31, 1885.

DRS. STARKEY & PALEN, Dear Sirs:

I am sorry you felt it needful to ask "permission" to do a thing so obviously right, and a thing that I am myself doing at every favorable opportunity, viz., state for the benefit of other sufferers what Compound Oxygen has done for me.

You certainly and most cheerfully have my unqualified permission to use any information concerning my case that you have, or that I can give you, though I suppose you have about all there is.

What it did for me is so remarkable that it is with diffidence I tell the whole truth, except where I am well known.

You remember the cause of my trouble is that during the war, at the battle of Fredericksburg, a Minie ball went crashing through my spine lengthwise, passing, the surgeons said, as close to the spinal cord as it could and not sever it. Inflammation was only prevented by constant applications of ice, at Washington, for a month afterward. By spells since, and sometimes for about a year together, the suffering amounted to extreme agony, so great that insanity it seems must have been the result had I not been quieted with morphine, before I got the Compound Oxygen. The last "pull" I had (and I had them at intervals of about two years) ended with the use of Compound Oxygen, in the summer of 1882.

The day the Compound Oxygen came I was not able to sit up to have my bed made, so sat up in bed to inhale, and thought as I did so, "Sold again, this will amount to nothing."

However, determined to follow directions, I inhaled again in the evening, and instead of six doses of morphine that evening, as on the last evening before, I only took one small dose, and slept more than usual, and better. The next night took no morphine and slept good eight hours, and in less than two weeks walked (on crutches) a quarter of a mile at a time.

Like most of all who get up feeling "so good," but whose judgment is as feeble as the body, I would overdo and get down, but I would get up almost as soon. These downs and ups covered a space of perhaps three months, since which time I have not been confined to the bed nor house for a day; but, of course, an injury so great is a permanent one; of such nature is the injury, that at times (more likely after a spell of writing) any person standing close to me, when I turn my head slowly, can hear a grating sound similar to that produced by rubbing a knife on a whetstone. Of course such a mangling and tearing of the nerves centering (do they not?) along the spine, leaves me in a constantly enfeebled condition; but when the brain feels strained, and the nerves sensitive, a few days' use of the Compound Oxygen brings back (has every time so far) an increase of vitality, and all the health that can be put into a body that has been so harshly handled, and much more than you doctors encouraged me to hope for when I asked your advice concerning it. I regard Compound Oxygen as nature's strong right hand for repairing bodily waste and damage. Yours truly, REV. J. C. SUNDERLIN.

FLEMINGTON, N. J., Sept. 20, 1886.

DEAR SIRS: I remain comparatively comfortable. The "house I live in" is shattered and torn, and as it is impossible to tear the whole house down, I have to do the next best thing, viz., to "strengthen that which remains" as well as I can, and my resort has constantly been, since the first remarkable experience with it, to Compound Oxygen.

In the use of this auxiliary of nature there is no remarkable shock of any kind given to the system.

I am now satisfied more than ever that the ABSENCE of such shock or thrill to the system is just precisely what should be.

Nature, in all her normal and healthful operations, works silently and quietly, and if measured by the moment, or perhaps even by the day or week, would be found almost imperceptible in her progress.

If we had not been sustained all our lives by breathing the atmosphere which surrounds us; who would believe in the seeming nonsense of breathing? It seems a mere nothing that we inhale and exhale fifteen or twenty times a minute, and yet we are dependent upon it for life. We could not endure its privation for five minutes, and yet that atmosphere can be so contaminated, and without arresting the attention of one of the senses, that it would not support life for twelve hours.

Such are the subtile influences which should be thought of, by those who have an idea that this remedy (Compound Oxygen) is not efficient simply because it is tasteless.

How foolish (?) to swallow down the tasteless draughts of limpid spring water, but how long could life be sustained without that tasteless beverage?

The glorious light of heaven comes to us in a quiet way, yet who can compute the actual uplifting power of the sunlight for one day in our hemisphere? The tons and tons of water and other material, in the form of grains, grasses, and fruits, actually lifted up from the earth by the quiet influence of the sun? Just such are the silent influences, though mighty forces, which are daily busy building up our physical structure, the mysterious temple which is so beautifully adapted for our dwelling place here a little while.

In connection with such thoughts I can easily apprehend, though I may not fully comprehend, any more than I can how the light accomplishes all its wonders, how this beautiful but potent vitalizer of the human body should so efficiently do its work.

It might be interesting to me to know (though not more useful) how the Compound Oxygen brings me a quiet, restful feeling that induces sleep, and puts nature in a condition where all her forces can be employed repairing damages; but though I may not know how the sunlight silently lifts, and colors, and improves all nature; may not know how the silent forces of attraction hold all things in their places; may not understand all the laws controlling the subtile operations of vitalization, and so not know how this sweet vitalizer and restorer of nature (Compound Oxygen) does its work; it is sufficient for me to know it does.

There must be the same patient, restful waiting for this that there must be for the natural growth of anything else, and then there will be the same rejoicing in the blessed realization of healthful happiness.

I am still as well as could be expected, taking the Compound Oxygen when the wheels of life show signs of friction, and need to run easier. But when, after an interval without it, I begin to take it, I generally sleep a little better the first or second night, and it is not like sleep induced by narcotics. Without it I have reason to believe I should not now be alive. Yours truly,

J. C. SUNDERLIN.

To learn "what Compound Oxygen is—its mode of action and results" send your address to Drs. STARKEY & PALEN, 1529 Arch Street, Philadelphia, Pa., and you will receive free, by mail, a work of two hundred pages, giving an interesting statement in regard to this simple remedy, with a large number of cases of cures by its use.

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Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Wanted—Competent draughtsmen, experienced in blast furnace and steel works construction. State experience. Address G. S. L., P. O. box 773, New York.

All Books and App. cheap. School Electricity, N. Y.

Economic gas engine cheap. W. E. Lewis, Corry, Pa.

Hasp lock patent for sale. C. P. Pond, Camden, N. Y.

Important legal decisions and Patent Office rules condensed, now ready at Washington for free distribution by W. X. Stevens, solicitor of patents.

For Sale—Complete fixtures of a well equipped job machine shop, including blacksmiths', pattern makers', and pipe fitters' outfits; also 500 miscellaneous patterns. All in place and in working order. Price, $4,000. Terms, $1,000 cash; balance, easy payments. Inventory furnished on application to J. F. Hammond, 117 South 16th St., Omaha, Neb.

Worth Remembering.

Every inspiration of the lungs, every pulse throb of the heart, every sweep of the arm, even our very thoughts as they speed through the brain, all create waste matter that must be constantly removed if there is to be that beautiful harmony of functional effort which constitutes health. Nature's remedy is the sure and eminently wise one of expelling, by proper purgation, the humors which cause disease, and Dr. Pierce's "Pleasant Purgative Pellets" are nature's great ally in the cure of digestive disturbances, and an unfailing remedy for constipation and its pernicious effects.

Small Metal Goods of every description made to order. Die work, etc. E. C. Ivins, 528 N. 10th St., Phila., Pa.

Machinist Foreman wanted who can handle fifty men to advantage and increase their production by latest improved ways of doing work. Address P., care of Wilkinson & Co., 352 Atlantic Ave., Boston, Mass.

Friction Clutches from $2.25 on. J. C. Blevney, Newark, N. J.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

A Catechism on the Locomotive. By M. N. Forney. With 19 plates, 227 engravings, and 660 pages. $2.50. Sent on receipt of the price by Munn & Co., 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Concrete Apparatus, etc. Ernest Ransome, S. F., Cal.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Wrinkles and Recipes. Compiled from the SCIENTIFIC AMERICAN. A collection of practical suggestions, processes, and directions, for the Mechanic, Engineer, Farmer, and Housekeeper. With a Color Tempering Scale, and numerous wood engravings. Revised by Prof. Thurston and Vander Weyde, and Engineers Buel and Rose. 12mo, cloth, $2.00. For sale by Munn & Co., 361 Broadway, New York.

Best Automatic Planer Knife Grinders. Pat. Face Plate Chuck Jaws. Am. Twist Drill Co., Meredith, N. H.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) S. & C. ask how to keep the frost, moisture, etc., off plate glass windows. A. Only by keeping the inside air dry, or by inner sash made tight, so that the air in window inclosure will be cold, and ventilated from the outside. A partial remedy is to have ventilating openings in the top of the window casing.

(2) M. M. A. asks if there is any hand power for propelling small boats that gives more speed than a pair of oars. A. We know of none that gives as good results as oars.

(3) W. S. C. asks why it is that some steam gauges are made larger than others. A. Only as a matter of taste. The small gauges are quite as reliable as the large ones, all being tested for the same pressures as indicated by their faces.

(4) F. B. S.—The so-called malleable iron is not fit to make castings of; it is as difficult to melt as wrought iron. You may melt steel at a very high heat. We recommend you to confine your work to the melting of soft gray iron. Good cast iron scrap mixed with charcoal or Scotch pig will make good, sound castings. See Greenwood on Steel and Iron, which we can mail you for $2.00.

(5) J. G. M. asks: 1. What pressure is produced in compressing 1 cubic foot of air into ½ cubic foot of air and ¼ cubic foot of air? A. 1 cubic foot to ½ cubic foot, 15 pounds pressure; 1 cubic foot to ¼ cubic foot, 30 pounds pressure. 2. Can this be done with a 20 inch Buffalo blower driven by hand? If not, how can it be done? A. It cannot. It requires a piston pump made for compressing air, which is on sale by the steam pump trade. 3. What pressure will ordinary ½ to ¾ inch gas pipe stand? A. ½ or ¾ inch gas pipe, if properly welded, will stand 1,000 pounds per square inch and upward.

(6) O. C. M. writes: I have a small flat steel article which needs protection from rust. Tinning alone will not answer the purpose. Galvanizing alone will do well, but is not quite bright enough to appear well. How would it answer to first galvanize and then tin? A. You can tin over the galvanizing without removing all the zinc by immersion in the tin bath, a thin coating of zinc and iron alloy remaining on the work; but the tin bath will soon deteriorate by absorption of the free zinc. If you can afford to renew the tin bath often, you will succeed.

(7) E. N. C. writes: A number of mechanics of this place respectfully ask: Does the entire boiler pressure come on the valve (of the ordinary slide valve engine) without reaction? A. The entire steam pressure is upon the valve. This is only partially balanced by the varying pressure of the steam in cutting off; the cushioning at the end of the stroke (if any), and the slight exhaust back pressure.

(8) W. & S. ask how to distinguish iron from steel. A. By breaking and comparing crystallized surface, or by immersing in nitric acid 1 part, water 3 parts, for a few minutes. Steel will show a homogeneous, granular surface. Iron will show a streaky or fibrous surface, or try whether the article is susceptible of tempering.

(9) D. P. B. asks how to prepare printer's ink so as to print on muslin with wooden type. A. Thin with boiled linseed oil, if it be absolutely necessary, but by doing the work slowly, and with the skill a good printer would exercise, you will get a better color if this can be avoided.

(10) W. F. E. asks how the acid for etching glass is made, that leaves the glass white and semi-opaque. A. See the article on "Fluoric Acid, its Preparation and Use in Glass Engraving," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 380.

(11) G. M. asks a receipt for making yeast to manufacture vinegar by fermentation. A. Boil 9 ounces of hops with 3 pails of water, put 9 pounds of good flour in a tub, and strain enough of the hop water over it to make it into a stiff paste, beat it up thoroughly, strain in the rest of the hop water into the paste, let it stand until lukewarm, then add 4½ quarts of stock yeast. It will rise 1 to 3 inches, but do not disturb it until it drops.

(12) G. Z. asks (1) whether there is any method of restoring paper which has been acted upon by oxalic acid, which was used to remove carmine ink stain, and turned the paper yellow. A. If the fiber of the paper has been destroyed by the acid, which is most likely, you cannot restore it. A little gum water may restore the finish of the paper. 2. What library contains the most books on chemistry? A. The library of Columbia College, corner 49th Street and Madison Avenue.

(13) C. A. C. writes: I am making a paper canoe, and I would like to have the receipt for making a waterproof shellac or varnish that will stick the edges of the paper together. A. One quarter of an ounce crude gutta percha dissolved in carbon disulphide to the consistency of mucilage.

(14) C. L. S. wants a receipt for liquid stove blacking. A. Pulverized blacklead 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce.

(15) E. H. C. asks the market value in New York or Brooklyn of the metal molybdenum or the mineral molybdenite. A. Metallic molybdenum has a value of about $50 a pound, but as there is no demand for it, it is unsalable, except in small quantities for museums or collectors. The mineral molybdenite is salable only to dealers in minerals.

(16) I. S. F. wishes to know the contents of a wall measuring 3 feet by 12 feet by 30 feet. A. The wall contains 1,080 cubic feet. If it is a rubble stone wall, it will be measured by the perch of 25 cubic feet, and will contain 43¼ perches. If it is masonry, it will be measured by the foot cube; and if brickwork, by the number of bricks it contains, viz., 24,300.

(17) E. E. S. asks: 1. Will you give some kind of wash or stain for brickwork that will protect the brick and not wash off without oil, and be permanent? A. To make a good wash for external purposes, rinse 1½ bushels of white lime with 3 pecks of hydraulic cement (say Rosendale or Portland) and add sufficient water and color as may be desired. Another is formed of ½ bushel of slaked quicklime mixed with ½ pound of sulphate of zinc, 1 pound of common salt and 1 gallon of sweet milk. 2. What is understood by a sounder (telegraphic) of 20 ohms? Does it mean 10 ohms on each spool and 20 on the pair? Or does it mean 20 ohms on each spool? A. A sounder of 20 ohms means one having a total resistance of that current on both bobbins. 3. Will a core made of ¼ inch iron wire do for magnet core on 20 ohm sounder? A. It would.

(18) A. B. B. says: I have a pound and a half of No. 18 cotton covered wire. Will you please inform me how I can make a continuous spark coil for gas lighting? A. You need much more wire. About five or six pounds of No. 24 magnet wire, wound on a bundle of short iron wires, eight inches long and an inch in diameter, will give good results.

(19) C. J. M. asks: 1. Can it be possible that permanent magnets could be so constructed so as to generate an electric current (without friction or motion), the same as cell or fluid battery? A. Unless our present theories are all wrong, it is impossible. We believe nothing can be done by experimentation in this direction. 2. Where can I obtain electric lamps such as described in SCIENTIFIC AMERICAN of October 16, 1886? A. Trouve, of Paris, makes such a lamp. Address Stout-Meadowcroft Company, 82 Fulton Street, New York, for general information as to electric lamps.

(20) G. W. C. asks how to preserve whole peaches so as to retain their natural size and color? A. Peaches are thus prepared for show purposes by submitting them to a bath of sulphur gas and a liberal use of antiseptics.

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October 26, 1886,

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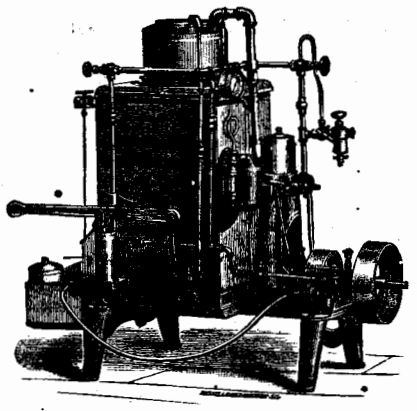

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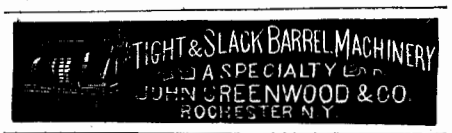

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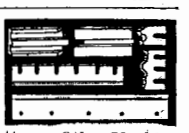

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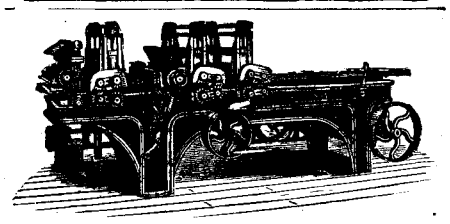

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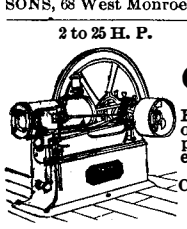

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TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 328 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	3¼ tons.
8 "	5 "
10 "	9½ "
10½ "	9½ "
12 "	12½ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4½ feet by 6 inches thick.

There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
Secretary of the Navy.

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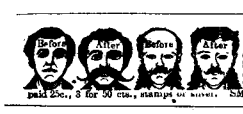

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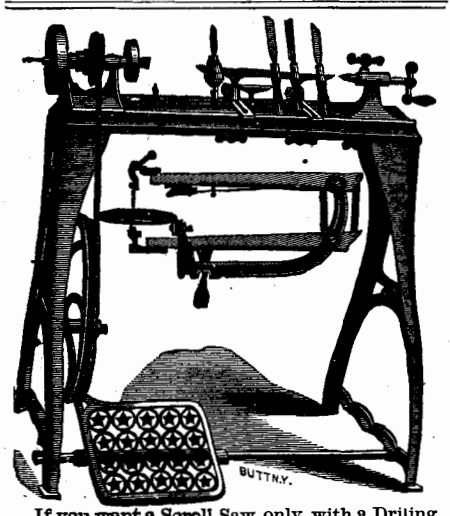

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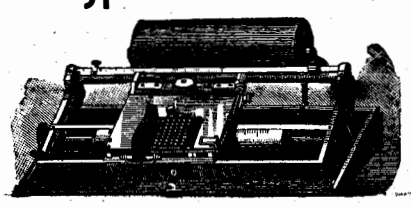

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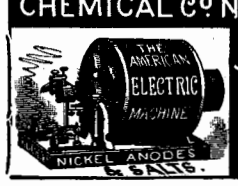

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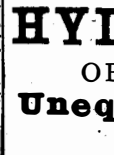

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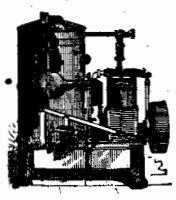

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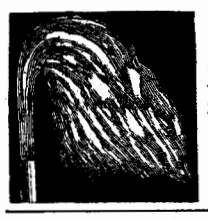

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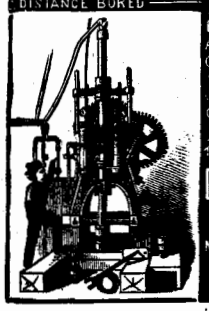

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